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MODEL AIRPLANE NEWS

RLD'S PREMIER R/C MODELING MAGAZINE

March 1993

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MARCH 1993 VOLUME 121, NUMBER 3

MODEL AIRPLANE NEWS

FEATURES

ABOVE: *Bob Fiorenze's F-14A Tomcat on display during the 10th annual Southwest Fan Fly.*

ON THE COVER: *Chip Hyde, who took 1st place in the '92 International Tournament of Champions (repeating his 1990 victory), smiles behind his Precision Built Ultimate biplane (designed by Bob Godfrey). The plane is controlled by a JR PCM10S radio, and it uses a Precision Eagle 4.2 engine, a Bolly 21x12 prop, a Slimline muffler, a Tru-Turn spinner and Power Master fuel.*

FEATURES

HELICOPTER SECTION

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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EDITORIAL

TOM ATWOOD

THE SPORT OF R/C

You may have heard people discussing whether R/C modeling is a mere hobby or a full-fledged sport. Oddly, this is a subject worth forming an opinion on. Many R/C activities span both categories, but many can only fairly be categorized as sporting activities, e.g., giant-scale racing (Unlimiteds and AT-6 classes), TOC competition, or senior-level scale competition like Top Gun. Similarly, the physically demanding segments of R/C soaring, or the eye/hand coordination required in pylon racing easily qualify these activities as sport endeavors (do skeet shooters or trout fishermen exert themselves more?).

There is a growing consensus that there is much to be gained if we all agree to describe the total spectrum of R/C modeling as a sport (albeit, one with a large hobby segment). I believe this is appropriate and only consistent with the development of R/C aeromodeling in recent years.

William Bennett (left)—chairman of the board, Circus Circus Enterprises, Inc., and the key force behind the Tournament of Champions since its inception in 1974—and editor Tom Atwood chat at the 1992 TOC. Mr. Bennett commented on the TOC's history and noted what the competition has shown in terms of the aerobatic competitiveness of scale biplanes. He deserves thanks from aeromodelers everywhere for his long-term sponsorship of this great aerobatic contest. (The next TOC will be held in 1994) See inside for highlights of what transpired at the latest TOC.

The question of how to categorize R/C modeling emerges under different guises. We have received more than a few letters from readers who, having left the hobby for a number of years, are shocked to find that the current prices of so many products wildly exceed their expectations. Could they be applying expectations developed on the hobby side to the contemporary sport segment of R/C modeling? I think this is probably the case. As in the case of other established sports, R/C products range in price from the inexpensive to the costly—there is something for nearly any size pocketbook. (As noted in Joe Jopling's letter to "Airwaves" this issue, the inflation-adjusted cost of many basic aeromodeling products has actually declined in recent decades).

How do attitudes compare in other countries? If you compare R/C modeling in Europe and the U.S., you will find that consumer expectations and consumption patterns differ slightly. European purchasers tend to pay more for their products, but they also expect a higher level of quality, and they often expect to use a piece of R/C equipment for a number of years. High-end European radios, which for years have had more model memories than U.S. radios, are examples of the difference in philosophy. The differences in general price acceptance between European and U.S. consumers (aided, somewhat, by the exchange rate) have resulted in some U.S. manufacturers exporting a growing portion of their products to Europe.

Yet—very generally speaking—the tradition in the U.S. has been to produce the least costly kits, because the modeling public has demanded inexpensive products. This demand has been built by generations of modelers who earned their spurs in clouds of balsa dust. The trend is slowly changing, however. R/C modeling is broadening. There are, for example, a growing number of fairly expensive TOC-level aerobatic aircraft now being produced, and the sales are there to justify the new products. What is causing this?

An aging generation of baby-boomer modelers now has more money to spend on bigger airplanes and more advanced equipment. Declining visual acuity is boosting the interest in giant-scale airplanes, and the shortage of time continues to fuel the ARF market. All of this is speeding the evolution of the "sport" of R/C modeling.

In the future, we may see hobby shops with a larger range of products and with a greater portion of pricier products. Hobby shops may come to look more like sporting-goods stores. Would this also help the hobby dealers and manufacturers, thereby strengthening the industry that supports R/C activity? This is food for thought.

I am not arguing that the least costly products should be replaced with more expensive ones. (If anything, we need really inexpensive—under $60—R/C systems that kids can afford, with, e.g., non-proportional actuator control.) As the market matures, many costs should continue to decline even as a greater diversity of products comes to market.

In the meantime, there is a certain legitimacy that the appellation "sport" confers on the activity when talking to non-R/Cers, e.g., when proposing event coverage to a television producer or negotiating with the local municipality for flying-field rights. For all these reasons, I argue we view and describe our modeling endeavors as a sport.

BOOKS YOU WOULD LIKE

We will be publishing several books over the next couple of years. Which books should we publish and in what order? Although we have several priorities in mind, there is no substitute for direct input from our readers. I invite comment from anyone who cares to participate in a mini-survey on modeling subjects we should cover in book form.

To have a voice in this decision process, send a postcard, a letter, or a fax. The scope of this fill-in-the-blank survey is wide open. Whether it is ducted fans, classic rubber-powered free-flight plans (yes, we will entertain non-R/C subjects), care and handling of giant-scale gas engines, building with glass and composites or *any other* modeling subject you would like to see a book on, just let us know. Your correspondence will make a difference. Write to Books, c/o Julie Soriano, 251 Danbury Road, Wilton, CT, 06897. Or send us a fax at (203) 762-9803. Thanks.

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THE WORLD'S PREMIER R/C MODELING MAGAZINE

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

CORRECTIONS

• We failed to include Joe Valvo's name as co-author of the review of the Global Skylane in our January '93 issue. Joe assembled, covered and outfitted the airplane and provided construction details. George Jenkins wrote the construction portion of the article in consultation with Joe.

• It is our policy to inform our readers if the author of a product review has an affiliation with the product's manufacturer. Following publication of the Model Aviation Technology (MAT) Extra 300 Field & Bench review by George Jenkins in our February '93 issue, we learned that he had become vice president of marketing of MAT (this relationship was created several weeks following his submittal of the article).

STARSHIP STATEMENT

I'd like to take a brief moment to let your readers know that both Dan Scherry and I were pleased with the treatment of our article "The Murder of a Starship" in the February '93 issue of *Model Airplane News*.

Also, your readers should know that although the article appeared in a different form in another magazine, it was printed there without our knowledge.

We, in fact, had an exclusive agreement with *Model Airplane News*. You might want to touch on the mechanics and ethics of submitting articles for publication.

TOM KRASIN
Avon Lake, OH

Thank you for setting the record straight, Tom. We were surprised to see the article in another magazine and would like our readers to know that it is not our policy to publish material that has appeared elsewhere. We received an expression of regret from the other publisher, but given the informality that surrounds the handling of articles in this industry, we understand how the mix-up occurred.

What procedure should be followed by authors? Contributors should submit a proposed article to one magazine at a time. Authors who write for special-interest publications—and teachers of college-level writing courses—will generally advise that simultaneously submitting articles to multiple publications is fraught with practical problems. Some consider it unethical.

The counter argument is that, by submitting the same article to more than one magazine and explicitly stating this in writing to each magazine, the author has a chance to see who will pay the most without misleading anyone. There are a few reasons why this is not necessarily the best approach. The submittal itself is usually viewed by the magazine as an offer by the author. After discussing price, proposed layout, and other details, the key item in the context of multiple, simultaneous submittals—whether a specific agreement was or was not reached and became a "deal"—can too easily get lost in the cracks.

Payments are usually standardized at any given magazine, and the author can quickly learn where to submit articles for the greatest return (incidentally, we offer very competitive payments). In many instances, placement of an article with a particular magazine is the primary consideration, not the dollar value of the payment.

There are risks for the author, too. If an article gets published in two different places, one of the first questions asked is why and how did the author permit this to happen? In this case, the authors did nothing technically wrong—they clearly stated that they had sent their article to other publications but that only one magazine would receive rights to publish it, and they ultimately chose Model Airplane News. That the mix-up occurred, however, despite the best intentions on everyone's part, underscores why it is advisable to submit a given article to only one magazine at a time! TA

COST OF MODELING—THE OTHER HALF OF THE STORY

I noted the recent comments by one of your readers regarding the high cost of modeling. I built my last model in the mid '40s. I'm preparing to retire and have started a modest reentry into the hobby. How times have changed—all for the better! The technology is fantastic. The availability of materials, hardware and gadgets is overwhelming. It's a hobby where anyone can find a niche that matches his abili-

ty and pocketbook. He can spend pennies on the challenge of making a peanut-scale fly, or he can spend thousands on a scale jet.

The prices are truly amazing when you compare them to what was available in the '30s and '40s. Based on hamburger and movie prices then, I would think that the inflation factor would be in the 25 to 30:1 range. But the U.S. Government says it is 8.8:1 from 1940 to 1990. Adding five percent per year for four years to get from 1939 to 1993 makes it an even 9:1. To the best of my recollection, a Torp .15 sold for $12.95 then—$126, escalated to 1993 and tax added.

Today's COX Black Widow puts out almost as much power, is much more reliable and costs $19, including tax. That is a whopping 85 percent saving over the projected '90s price. Another example is radios. A 4-channel digital proportional transmitter, receiver, Ni-Cds, servos and charger sells for $120. In 1939 dollars, that's $13.33. Dr. Walt Good probably paid that for the 100-yard extension cord I've seen in early R/C photos.

My thanks to the modelers, the manufactures and the magazine publishers who have worked so hard for the past 50 years, all to make it so pleasant, easy and affordable for me to come back today.

JOE JOPLING
Fort Worth, TX

Mr. Jopling, I'm sure you're referring to Walter E. Emery's letter titled "The Cost of Modeling, Then and Now," which appeared in the November '92 "Airwaves." Your side of the story holds much credence as it comes from the reader/consumer side. Thank you. Of course, we agree with you on this.

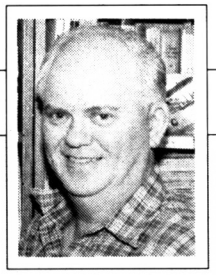
CC

PROP-ER BALANCE

I have just started my model-airplane hobby. I've bought my plane and all the other equipment that I need. In your magazine, I see ads from Du-Bro and Robart that advertise something called a "prop balancer." Why do we need to

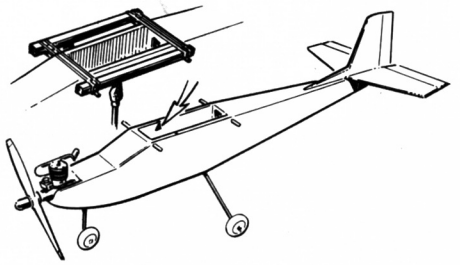
(Continued on page 137)

HINTS & KINKS



JIM NEWMAN

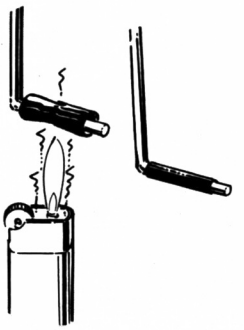
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



FUSELAGE BALANCE POINT

After you've successfully flown your model and determined the best balance point, remove the wings and use a couple of sticks to determine the balance point of the fuselage, as shown. Now, when you make repairs or extensive changes, you only have to re-balance the fuselage, and you won't be encumbered by wings in your small shop. Be sure that you mark the fuselage balance point *inside* the fuselage.

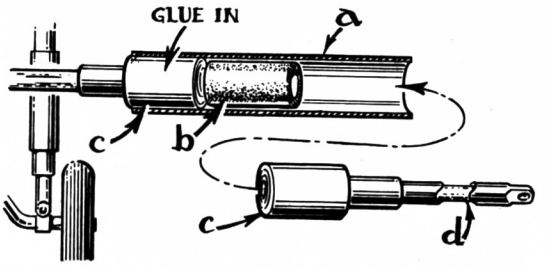
Lloyd Ressler, Buckinghamshire, England



QUICK BUSHING FOR SMALL WHEELS

If an axle is just a little too small, shrink a piece of heat-shrink tubing over it. This is often just the thing to eliminate wheel wobble.

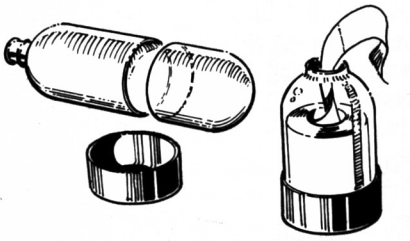
Animor Dobrovich, Uppsala, Sweden



LANDING-GEAR SHOCK STRUTS

This works on a small model (049), and you could scale it up. The cylinder (a) is aluminum tube, the rubber compression spring (b) is rubber fuel line and the pistons (c) are made of layers of aluminum tube that have been glued together with CA. The piston rod (d) is ⅛-inch dowel that has been inserted into aluminum tube. Note how one piston is glued into the cylinder and acts as a top stop.

Vern Zundel, Warrington, FL



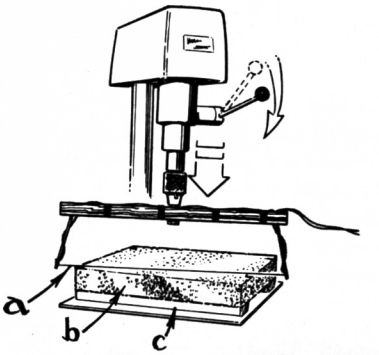
TISSUE DISPENSER

Take the base off a plastic soda bottle, cut the neck as shown, shorten the bottle as required, remove the cardboard tube from the center of a toilet-tissue roll, then reassemble the bottle with the roll inside after feeding the tissue out through its neck. Note: the tissue must be extracted from the center of the tissue roll for this to work.

Fabio Nobre Gil, São Paulo, Brazil

WEIGHTED WATERPROOF COVER

Don't be caught out by a sudden monsoon! Cut a large sheet of polyethylene sheet, fold the corners to make pockets. Fill them with ballast—sand, lead shot or smooth gravel—and use duct tape to seal them. When the rain comes, drop your weighted sheets over your models and equipment. ***John Wapensky, Summit Hill, PA***



DRILL PRESS HOT-WIRE CUTTER

Mount the bow (a) in the drill chuck (put a bolt through the bow's center). Use this setup to make vertical cuts by pulling down on the handle. To reduce the thickness of a foam slab (b), turn the bow crossways, lock the chuck at the desired height then push the slab through. The small sticks (c) allow the wire to emerge on the bottom. Place a thin sheet of Masonite or heavy cardboard below the sticks to prevent the cutting wire from shorting out against the drill-press table.

Jef Raskin, Pacifica, CA

AEROBATICS MADE EASY

DAVE PATRICK

BALANCING ACT

THERE IS MORE than a little controversy about how an airplane should be balanced. This month's column will attempt to explain in simple terms the hows and whys of proper balancing so that you can get the most out of your aircraft.

The really good news is that proper balancing can have a profound effect on the character of your aircraft in flight. If the CG is too far aft, your plane will be too unstable to fly. If it is forward, your plane will become docile in pitch. By moving the CG from a slightly forward position to a slightly aft position (and increasing the throws), you can convert your sport plane into a real hot-dogger. A properly adjusted CG is the key to performing certain aerobatic maneuvers. So it's worth the effort to take the extra time to measure the CG accurately.

A popular, quick and easy technique to determine the CG is to balance the model on your fingertips near the wingtips. Modelers will quickly "eyeball" the model to see whether it balances approximately one-fifth to one-third of the chord back from the leading edge. This is not a bad way to do it, but it really isn't accurate enough to do the job right. I like to use a fixture designed for this task. (See Figure 1.)

When balancing a model, I like to tape a piece of 1/32- or 1/16-inch ply approximately 1 1/2x3 inches square on the wing surface where the model is balanced, to protect the wing from damage. Always measure the CG with no fuel on board!

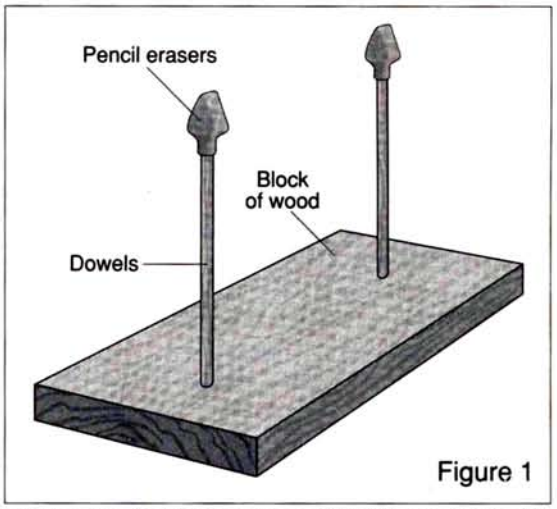


Figure 1

Simple apparatus for balancing a model while locating the CG.

WHERE SHOULD I BALANCE?

Always start with the CG point within the manufacturer's recommended CG range. If you don't have this information, a good place to start for most "conventional" aircraft is about 30 to 33 percent of the mean aerodynamic chord (MAC) for a monoplane, and about 25 to 30 percent of the MAC for a biplane.

Let's quickly go over what the MAC is. I'll first give you a technical definition, and then look at an approximation of the MAC that will do the job for purposes of finding the CG on most models. We can use an approximation because locating the CG on the MAC is only the first step. Once that point has been found, you will adjust the CG to suit your flight-performance requirements.

The chord is the width of the wing at a particular point. The MAC is defined in "Peery's Aircraft Structures," by David J. Peery (published by McGraw-Hill, 1950) as follows: "For a rectangular wing planform, the value of the MAC is equal to the wing chord, and for a trapezoidal planform of the semi-wing, the value of the MAC is equal to the chord at the centroid of the trapezoid." If you have a swept, tapered wing, the true MAC (located at the "centroid") will be slightly inboard of the approximated MAC that I use. (For graphical and arithmetical methods of precisely computing the MAC, see "How to Compute the Mean Aerodynamic Chord" by James McClure, page 54, April '92 *Model Airplane News.)* The position of the CG on the approximation shown here, however, will be close enough to get you started with balancing your model accurately.

In my approximation, I assume that the MAC is the average chord found in the "middle" of the wing. The calculation is simply:

—Measure the chord of the wing at the

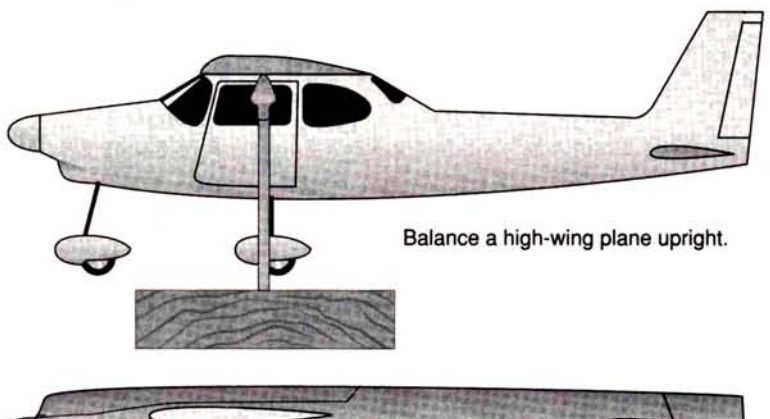
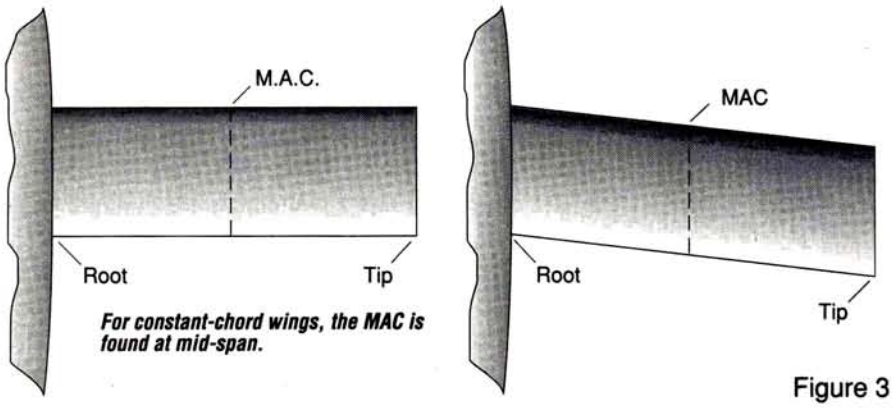


Figure 2



For constant-chord wings, the MAC is found at mid-span.

Figure 3

root, e.g., let's say it is 8 inches.

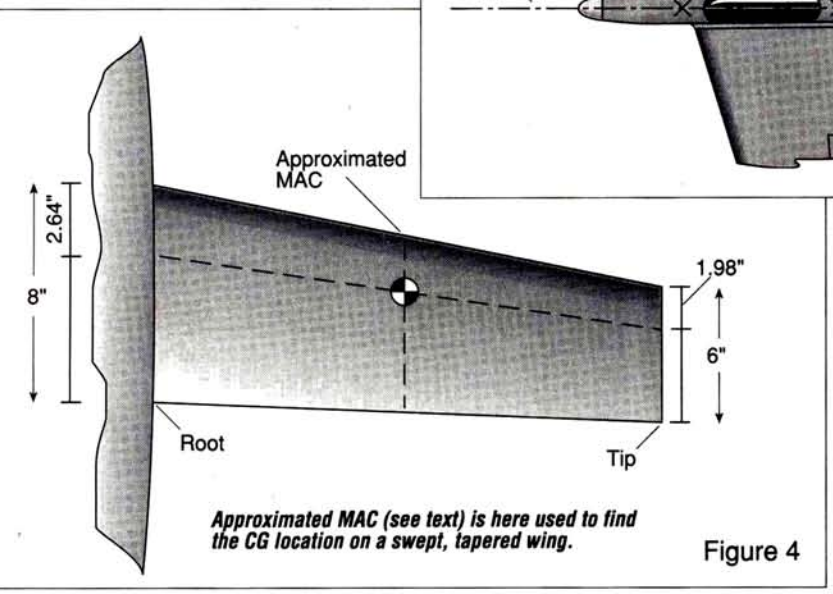
—Measure the chord of the wing at the tip, e.g., let's say it is 6 inches.

—Determine what percentage of MAC you want to find, e.g., let's say it's 33 percent. We would find that:

—33 percent of an 8-inch root chord = 2.64 inches.

—33 percent of a 6-inch tip chord = 1.98 inches.

Next, measure back from the leading edge at the root chord 2.64 inches and back from the leading edge at the tip 1.98 inches. A line between these two reference points is the "average 33-percent line."



Approximated MAC (see text) is here used to find the CG location on a swept, tapered wing.

Figure 4

point of the fuselage at the nose and tail, and balance the plane laterally with the wings on. Suspend the model as shown in Figure 5, and add weight to the lighter wing (drive small nails into the lighter wingtip) until neither wing tips downward. All aircraft should be put through this procedure. It's easy.

A couple of final hints. Start flying the plane with a slightly forward CG. On later flights, move the CG forward or aft in small increments to suit your flying preference. Next month, we'll take a closer look at the effects on flight performance of moving the CG forward or aft, and how you can determine, in the air, whether your CG is set up correctly. See you then.

Cut this line in half; at the dividing point, you will have an approximation of the 33 percent MAC balancing point. This point is 33 percent back from the leading edge and halfway between the root and the tip. (See Figure 4.)

To determine where this point can be found at the wing root or fuselage, simply find the 33 percent MAC point for the other wing. With a thread drawn between these two points, you can easily note anywhere along the wing or fuselage where the 33 percent balance point will be.

This system works well on most straight leading- and trailing-edge wings. Ignore a faired or shaped tip; it is insignificant. Also ignore any wing fairing at the fuselage.

Let's also check its lateral balance, i.e., check to see whether you have a heavy wingtip. Simply determine the center

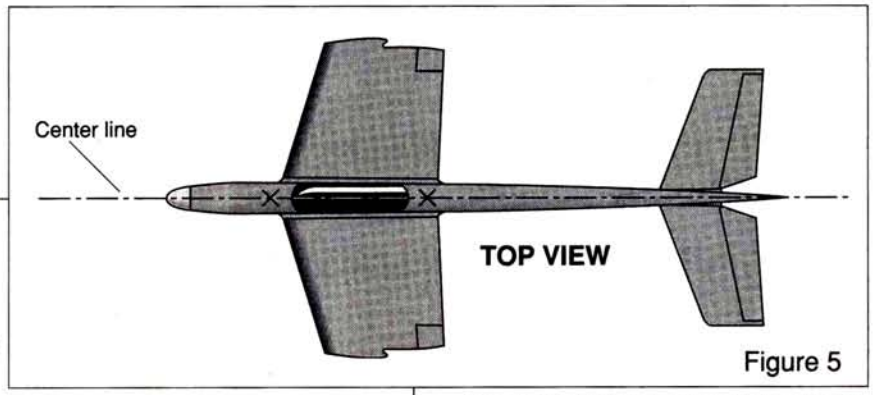


Figure 5

When balancing your model laterally, supend the plane from the center of the fuselage at the nose and tail.

AIR SCOOP

CHRIS CHIANELLI

New products or people behind the scenes—my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares?—it's you, the reader, who matters most! I spy for those who fly!

Astro 36-Cell Peak Detector

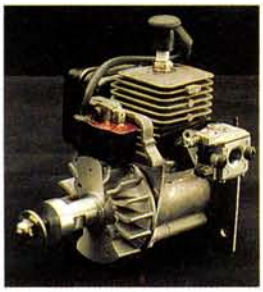
Astro Flight has completely redesigned its popular model 112 charger to incorporate peak detection and, at the same time, has increased its cell-charging capability to 36. The new model 112PK features electronic protection of both input and output against overload and polarity reversal. Other features include an auxilliary 100mAh trickle-charge (so pilots can top-up their motor batteries) and a built-in cooling fan. There's no price information yet, but I understand it will be very competitively positioned. For more information, contact Astro Flight Inc., 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242.

HAVE LEAD, WILL FLY

A unique weightlifting event was featured at this year's Astrochamps II Contest on November 7 and 8 at Mile Square Park in Fountain Valley, CA. Some of the ground rules were: the model must be powered by a stock Astro 05 that runs off 7 cells. The maximum allowable wingspan is 100 inches, with no more than a total lifting area of 1,200 square inches, including the fuselage and the stabilizer. The aircraft must have an internal cargo bay that measures 2x3x5 inches, and it must take off and land upright within 200 feet. Flight must last at least one minute. The interesting yellow-and-orange 3-pound High Planes Lifter built by Joe Ballash placed second by lifting 9 pounds, 7 ounces. The pink-and-white, 4-pound, Maxi Fly built by Chuck Hollinger took first by lifting 10 pounds, 4 ounces. At a total flying weight of 14 pounds, 4 ounces, the Maxi Fly was doing its thing at a wing loading of 34 ounces per square foot!—a respectable achievement, to say the least.

Bob Ortman's 76-inch-span Northrup N9M-A Flying Wing was from the sport-scale part of the Astrochamps II event. This is a very striking model, both on the ground and in the air. It weighs 6 pounds, 8.5 ounces, and is powered by two Astro Cobalt 05s turning 8x5 Rev-Up props. The aircraft has retractable trike gear and leading-edge slats that help to produce superb flight performance. I thank Warner Lowe for sending us the photos and information.

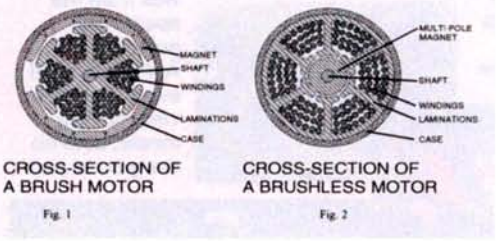
Enforcer APU-30



Warehouse Hobbies, well known and respected for its Enforcer line of ignition-powered racing boats, introduces an American-made 30cc gas engine—the APU-30. The APU-30 features a high-performance carburetor, a firewall mount, a muffler, a resistor spark plug and a one-year Enforcer warranty (not a crash warranty). The APU-30 will handle models up to 15 pounds. Suggested price: $229.95; introductory price: $189. For more information, contact Warehouse Hobbies Inc., 821 NW 44th St., Oakland Park, FL 33309; (305) 351-9228.

AIR SCOOP

Brushless motor coming to our Hobby?



CROSS-SECTION OF A BRUSH MOTOR
Fig. 1

CROSS-SECTION OF A BRUSHLESS MOTOR
Fig. 2

Aveox presents technology that has the potential to change electric-powered flight forever: brushless DC motors. In today's typical motor, the magnets are mounted on the case, while the windings are on the armature. As the motor spins, brushes rub on the commutator plates, switching the polarity of the armature coils. This is often called a "moving coil design." (See Figure 1.) The brushless motor is sort of like a brush motor turned inside out. (See Figure 2.) A shaft with a permanent magnet is mounted on two ball bearings, and the windings are fixed to the case. The polarity of the windings is electronically switched to keep the magnet-shaft spinning. Brushless motors are nothing new, but Aveox seems to have developed electronic switching that's fast enough to attain the necessary rpm for our hobby. The advantages of a brushless motor are longevity (no brush or commutator surface to wear) and no brush arcing, which can be a source of interference. These motors could also increase efficiency and run time. We'll keep you posted. The retail price will be approximately $400, including speed controller. For more information, contact Aveox Inc., P.O. Box 1287, Agoura Hills, CA 91376; (818) 597-8915; fax (818) 707 9792.

Byron Gone Turbine

This energetic Japanese modeler has taken two French-made JPX Turborec T-240 jet-turbine engines and mounted them in a 69-inch-wingspan Byron F-15. These engines run on propane (be careful) and produce only 75dBs of exact scale sound; I've heard these things first-hand, and they sound like G.E. J79s—no kidding! Anyway, this Byron/turbo-jet conversion is also equipped with brakes and spoilers. Those of you interested in the Turborec T-240 should write to JPX Propulseurs D'Aeronefs, Zone Industrielle Nord, 72 320, Vibraye, France.

FLYING BOAT-HEMOTH-SAN

Here's yet another example of Japanese modelers taking things to the extreme. (Top photo.) This is a 29-foot-wingspan Catalina MKIII as its twin O.S. 5-cylinder radials throttle-up for the takeoff run on its maiden flight. The 224-pound flying boat sports 16,560 square inches of wing area, giving this shoulder-high PBY a wing loading of 31.2 ounces per square foot—quite light for a model this size, I speculate! The 18-foot-long fuselage is constructed of foam and fiberglass, while the wing and stab are of relatively conventional balsa-and-plywood construction. Other features are oil-damped retractable gear, hinges that incorporate 10mm aluminum tubes for pins and an Airtronics Infinity 1000 operating 25 servos. The first flight was a success of mammoth proportions.

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects", we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1993. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

SMARTT LOOKIN' MODEL

Jerry Smartt of Warsaw, MO, built this beautiful old-time design of the famous Brooklyn Dodger. Does the ignition engine look a little odd to some of you? Jerry used an old Fox .35 to create a dummy engine; the model is really powered by a geared Astro .25 electric and 15 900mAh cells. This setup is certainly a Smartt idea, don't you think?

THAT WAS THEN; THIS IS NOW

Both of these photos are of Paul Brown of Marion, IN. One shows him today with his Como .51-powered, metallic-MonoKote-covered Super Decathlon 40; the other shows him 55 years ago with his Brown Jr.-powered, bamboo-paper-covered Quaker Flash. (Back then, *Model Airplane News* sold for 15 cents!) Obviously, modeling has kept Paul youthful.

BARON VON JOE

Sixty-nine-year-old Joseph Karpowich of Mawah, NJ, scratch-built this big, beautiful, G38-powered Fokker D VII from Rich Uravitch plans. During its first flight, the rudder hinge pins fell out! The rudder was left flapping in the breeze, held in place only by the pushrod. Jay, Joseph's son and number-one test pilot, still made a beautiful landing. According to Joseph, one spectator remarked, "Uravitch really designed that plane to be stable...." Joseph agrees: "Rich deserves all the praise in the world for his hand in this great plane."

PILOT PROJECTS

THE BROTHERLY LOVE OF UNCLE BO

Pictured here is Bert "Bo" Ziroli of Galaway, NY. Yes, indeed, Bo is the brother of the infamous, sometimes cranky, but always lovable designer, Nick Ziroli. Bo is an avid modeler who loves to build from either kits or plans. Being a Ziroli, you'd think he would choose from his brother's plans or his nephew Nick Jr.'s kits, but noooo! The photo clearly shows his preference: three Randy Randolph designs—the Bee-Tween, the Spirit of '74 and the Twilighter II—all offered by *Model Airplane News*. Give your brother another chance, Bo; after all, his crankiness is only skin deep.

BECCO'S BIGGY

Steve Becco Jr. of Colorado Springs, CO, designed and built this 10½-foot-span "senior-size" giant. (By the way, Steve, what's the name of this model?) Made of hemlock, balsa and fabric, the Quadra 42-powered model weighs 19 pounds and features dual-servo ailerons, dual-servo rudder/nose gear, plug-in wings and a semisymmetrical airfoil.

MONTY'S FLEET

Monty Hart, of Barrie, Ontario, Canada, was on the tarmac in June 1940 when the Royal Canadian Air Force (RCAF) Fleet Finch 16B (no. 4587) landed for repairs. Monty was serving in the British Commonwealth Air Training, and he worked on the plane until August 1940. He then joined the RCAF, and on August 6, 1942, as a student pilot, he soloed in a deHavilland Tiger Moth DH82C (no. 5973).

SWEDISH GERE

Alvar Elvberg of Älvdalen, Sweden, built this Gere bipe from a Bud Nosen kit, but he added much to enhance its scale appearance. Alvar says that he and some "other boys" who love the Gere hold a fly-in every summer. If any traveling modeler wants to join in on this Swedish fly-in, write to Alvar at Rot 215, 90 796 Älvadalen, Sweden.

HOW TO

Wing Design, Part 3

by ANDY LENNON

TIPS ON WINGTIPS

WITH HIS NECK "stuck way out," this author suggests the following classifications for radio-controlled model aircraft:

Power Loading Model Type	Wing Loading ozs./cid-2-stroke	Wing ozs./sq. ft.	Aspect Ratio
High-speed, highly maneuverable	200-250	22 to 26	4 to 6
Moderate-speed sport	250-300	16 to 22	6 to 8
Low-speedtrainer	300 and up	12 to 16	8 to 10
Slope gliders	—	12 to 14	8 to 10
Soaring gliders	—	8 to 12	10 to 15

From this designer's point of view, to obtain the maximum efficiency, careful drag reduction is needed (*Model Airplane News*, January, February and March '92) along with sound propeller selection (*Model Airplane News*, November and December '92). Higher flight speeds result with lower lift and profile drag coefficients and lower induced drag until the total drag equals the thrust. To provide the optimum strength-to-weight ratio to overcome high centrifugal force loads, stressed-skin structural design is suggested (*Model Airplane News*, September and October '92). To reduce landing and takeoff speeds, slotted flaps are recommended (*Model Airplane News*, October and November. '91).

STALL PATTERNS—LIFT DISTRIBTION AND STALL AVOIDANCE

Figure 7 illustrates how the various wing planforms stall at high angles of attack. Note that the rectangular wing stalls root first, permitting effective aileron control well into the stall.

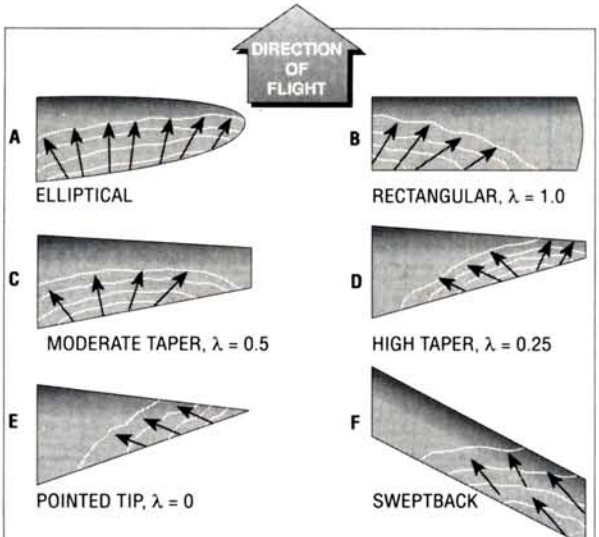


Figure 7 **Stall progression patterns for various planform wings.**

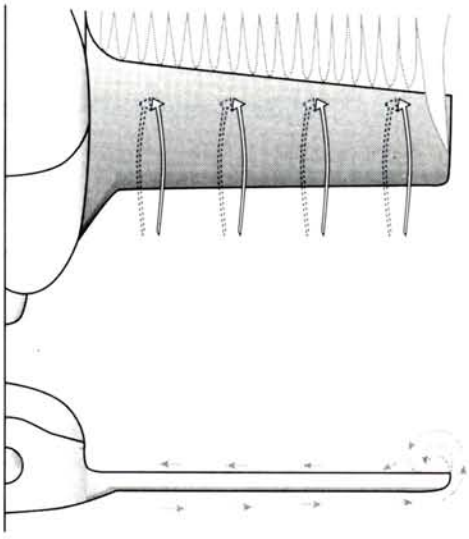


Figure 8
As air flows past a wing from leading edge to trailing edge, positive pressure is created below the wing, while negative pressure exists above. At the wingtip, the positive-pressure bottom wing air flows around the tip and is drawn into the negative pressure region above the wing. This action gives rise to the wingtip vortex, as well as to lesser vortices along the trailing edge.

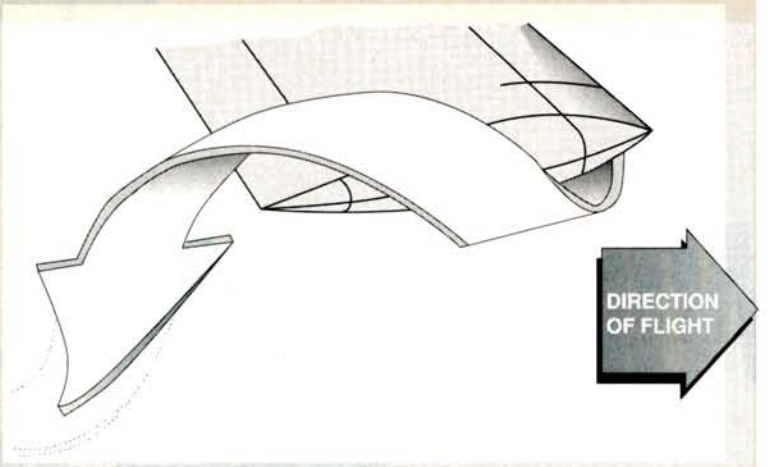


Figure 9 **An illustration of the wingtip vortex flow.**

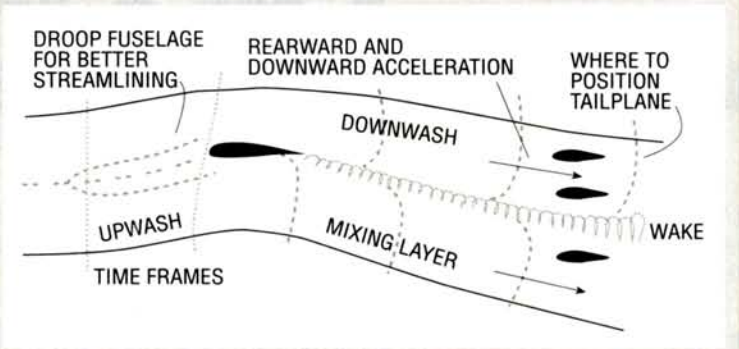


Figure 10 **The downwash and wake for a conventional, rear-tailed aircraft. Note the suggested droop fuselage that would decrease drag. Time frames above the wing are spaced farther apart to illustrate higher velocity air.**

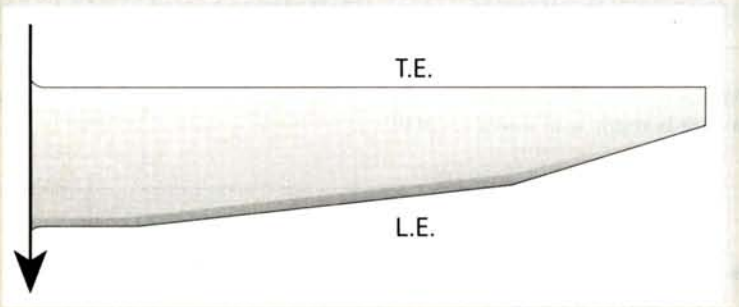


Figure 11 **The Schuemann wing planform.**

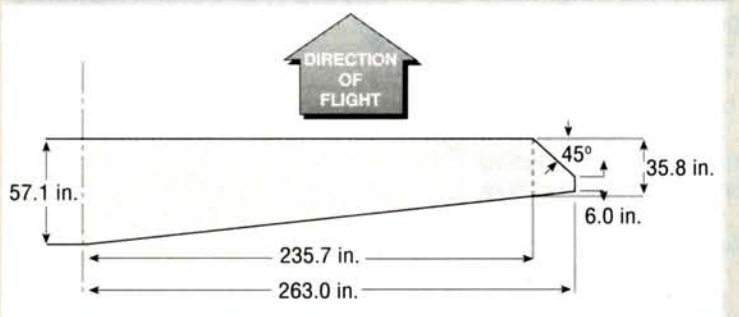


Figure 12 **Modified wing planform geometry; 45° swept tip.**

There are a variety of ways in which tip stalling may be delayed to higher angles of attack. The best and simplest form is the NASA-developed and tested partial-span wing-leading-edge droop (*Model Airplane News*, June '90). This feature has been used very successfully on six of my model designs.

WINGTIP DESIGN

The major difference in efficiency between the elliptical planform, considered the best, and other planforms is largely due to wingtip losses. The elliptical has no pronounced tip—one could say it is "all tip"—whereas the rectangular planform has the widest tip. Tapered wingtip widths vary with taper ratio.

Figures 8 and 9 portray the airflow over and under a wing and particularly the tip vortex flow. Figure 10 shows the wake and downwash resulting from the wing's production of lift. Tail-surface design and location will be the subject of future articles.

Obviously, the narrower the tip, the lower the tip losses with due regard to stall patterns and scale effect, particularly at low speeds. A tip stall close to the ground may be damaging to both model and its designer's ego!

Over the years, aerodynamicists have explored many wingtip configurations in their search for improved wing performance. Two forms, somewhat resembling each other, have emerged.

First is the Schuemann planform (Figure 11), described by its designer in *Soaring* (February '83). More information on this planform appears in *RCM*'s soaring column in the July and August '92 issues.

The second is the "sheared" wingtip, largely developed by C.P. Van Dam of the University of California. Figures 12 and 13 provide an outline of a sheared tip along with its spanwise load distribution. Note how close "modified" is to "elliptical" in Figure 13. This form of tip has been, or is being, applied to full-scale aircraft designed by such noted aerodynamicists as Burt Rutan and Peter Garrison. Figures 14 and 15 illustrate these designs.

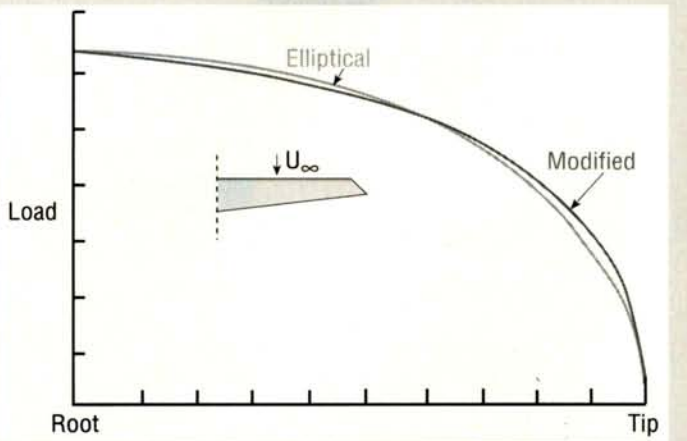


Figure 13 **Spanwise load distribution of modified wing at C_L=0.40. The wing features a 45° swept tip.**

This author uses a modified sheared wingtip that is both simple and rugged. Figure 17, a top view of the Snowy Owl's (*RCM*, January '89) wing, illustrates this tip form.

FLAP CHORDS

Earlier model designs such as the Snowy Owl had slotted flaps whose chord was 26 percent of the wing's chord and were close to 60 percent of the wing's semi-span in length (see Figure 17).

After throttling back and fully extending the flaps, these models porpoised upward suddenly. Elevator down-trim applied simultaneously with flap extension would prevent this behavior, which was annoying.

Analysis disclosed that the increase in angle of downwash from the extended flaps was forcing the tail plane down and created a greater force than the increase in nose-down pitch. The wing's angle of attack and lift increased, and the model zoomed upward until the excess speed bled off. The model then nosed over into the flap-down, slow glide.

Experience with my last three models (Seagull III, *RCM* October '92; Sea Hawk, *Model Airplane News* October '92; Swift, to be published) has proven that widening the flap chord to 30 percent of the wing chord produces a balance between these "nose up" and "nose down" forces, flaps fully extended. All three models exhibit no change in pitch on lowering flaps—but fly much more slowly.

On landing approach, ground effect reduces the downwash angle and increases the nose-down pitch. The glide close to the ground steepens, but appropriate up-elevator action raises the nose so that a gentle, slow landing results.

Happy one-piece landings.

In the January 1993 issue of *Model Airplane News*, on page 44, the captions for Figures 1 and 2, which depict straight- and tapered-wing correction factors, were reversed. "Airfoil Selection" parts 1 and 2, published in the May and June 1992 issues, describe these figures and their use in detail.

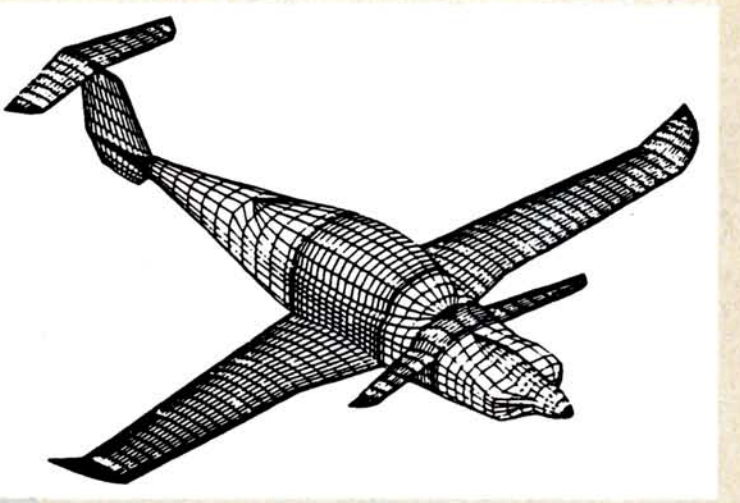


Figure 14 **Rutan model 81 Catbird. Note three surfaces.**

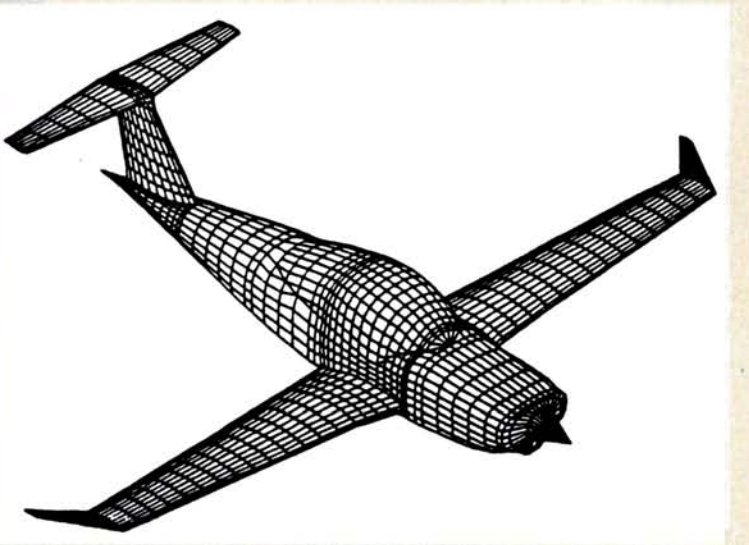


Figure 15 **Peter Garrison's Melmoth 2.**

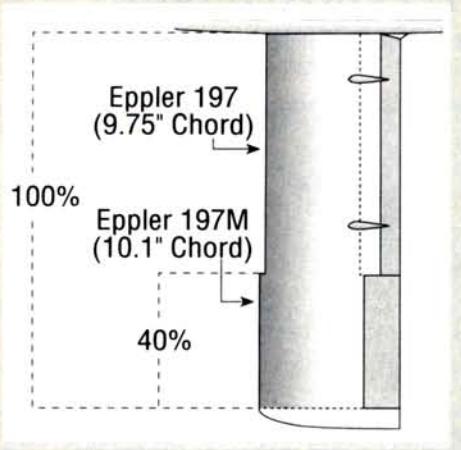


Figure 17 **Snowy Owl's flaps were 60% of the wing semi-span.**

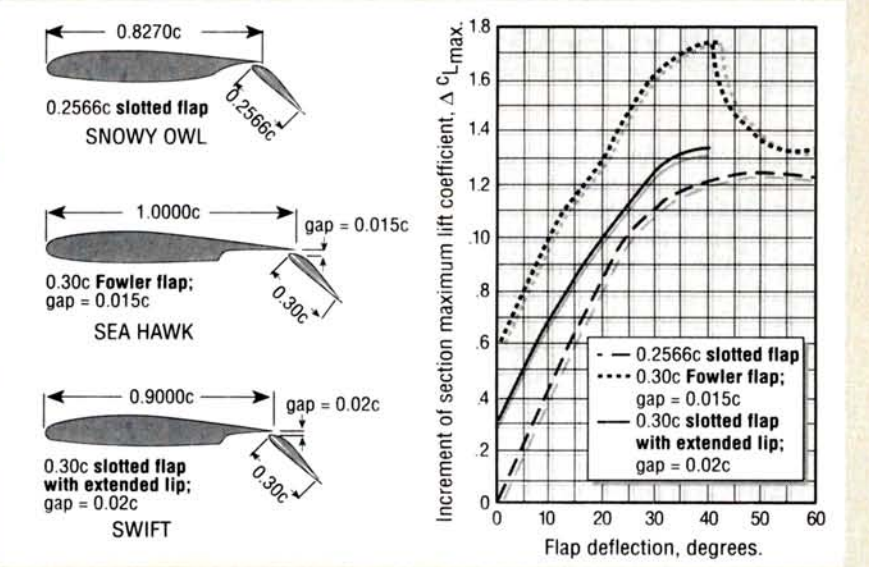
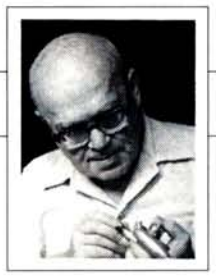


Figure 16 **Comparison of increments of section maximum lift coefficient for three flaps on a NACA 23012 airfoil.**

SMALL STEPS

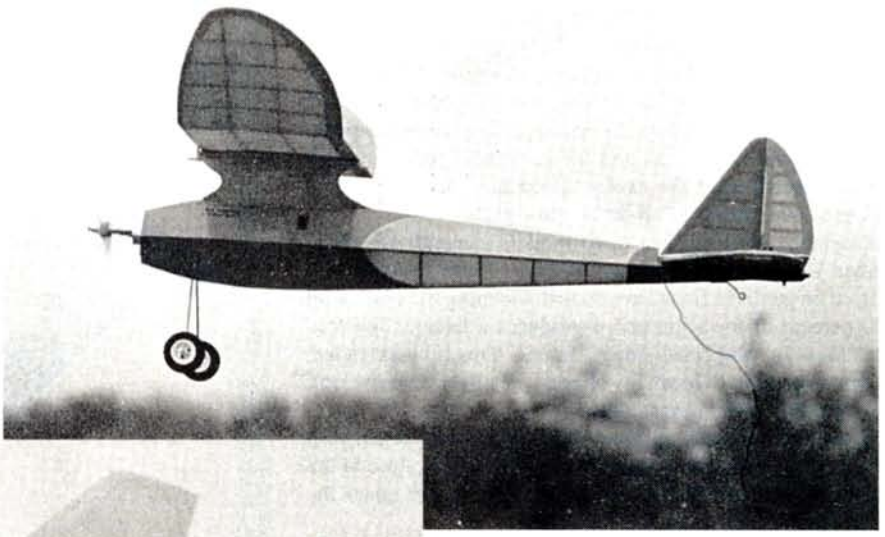


JOE WAGNER

THE EFFICIENT MINI-MOTOR

THOUGH LONG dominated by 05-size motors, electric-powered R/C has recently hit the big time. Bob Kopski tells me that at the most recent, extravaganzant, all-electric KRC exhibition in Quakertown, PA, most participants used 25-size motors, at least.

Yet for sport flying, 30W and 50W motors, e.g., Peck Polymers'* Silver Streak, HiLine's* IMP-30 and ELF-50 and Graupner's* Speed 400, have two advantages. First, their low current consumption makes it possible to recharge flight batteries from a portable power supply, instead of from an automobile battery. Second, the smaller motors and battery packs cost much less than the "biggies," yet they perform just as well—provided that they're suitable for the model.



Bob Markle used one of his own gearboxes with the 30W electric motor in this mini old timer, Thermal Thumber.

This scale Bebe Jodel by George Minnear of Penn Hills, PA, shows how realistic a small, simple, electric-powered R/C airplane model can be.

Not many kits for 30 to 50W motors are available yet. Idealair* makes an electric-powered version of its Sky Elf; Graupner recently introduced a 51-inch-wingspan, almost-scale Klemm L-25 and a 52-inch-wingspan Partenavia P-68 Twin. Both use the Graupner Speed 400 motor; and Sure Flite's* ½A Piper Cub J-3 and Cessna 180 can both be easily adapted for 30 to 50W electric power.

However, there are many designs available that you could alter to make excellent small electric R/C projects—for example, Comet's rubber-powered, scale, 26-inch S.E.5A. All the model magazines have scads of full-size plans for small free-flight and R/C airplanes that you can convert, or scale-down to produce off-the-

GEAR-DOWN WITH GRAUPNER

One key to obtaining optimum performance from a small-motored electric R/C airplane is gearing-down the propeller. Graupner's 1703 gearbox line for its Speed 400 is an excellent way to do this. This design is light, yet rugged, and it offers gear-down ratios of 1.5, 1.85, or 2.33. It runs so smoothly that even the high reduction drive adds no appreciable drain to the motor current. A unique feature of these new Graupner gearboxes: they allow cooling air to pass through the motor case, rather than blocking off the whole motor front as most other gear-reduction drives do.

Graupner's new Speed 400 boasts the highest efficiency of the inexpensive 50W motors. With the gear drive shown, it mounts like a glow engine and develops the thrust of an .049.

beaten-track sport R/C airplanes for 30 to 50W motors.

Still, making such a conversion successful requires design consideration. Some very appealing projects would not work, e.g., many of the colorful Guillows warplane kits.

How can you tell whether a design is suitable? It's easy—provided you have access to an IBM-compatible computer. Ken Myers* has developed a simple, inexpensive computer program that can predict the flight characteristics of just about any electric-powered R/C model project you would ever want to try. Just give the computer the dimensions of your proposed model and the motor/prop/battery combination you intend to use. The program takes it from there, and you'll be provided with a detailed analysis of:

• how much your finished model is likely to weigh;

• how well it will fly: takeoff ability, top speed, stalling speed and maneuverability;

• how long the motor will run per charge.

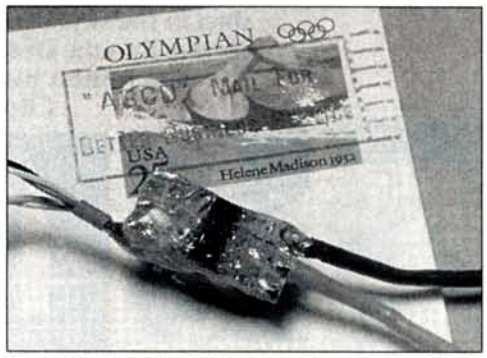
It took Ken Myers four years to develop his Electric Flight Prediction program, and he had help from noted electric-power authorities Bob Kopski and Dr. Keith Shaw. The program covers a variety of planes and motor combinations: monoplanes, biplanes, triplanes and any number of motors from single- to four-motor designs. The program doesn't require that you have full-size model plans. If you enter data from a reduced-scale magazine plan, the program will automatically make all the required calculations. It even tells you how much the small-size plan must be scaled up for your project!

Ken is offering "Small Steps" readers a discount on this program: $16, postpaid. It's well worth the money!

LIGHTEN UP!

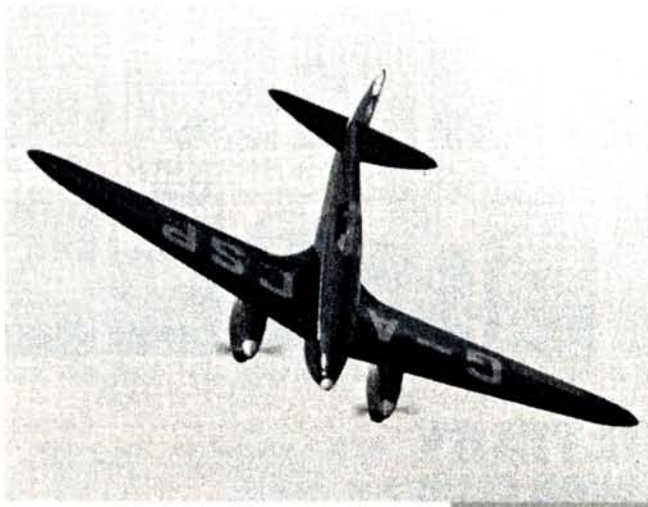
Obviously, another key to maximizing the flight performances of small electric R/C planes is to keep them light. Every gram you save on a 240-square-inch airplane will provide you with better performance and longer flight times.

A good weight- and space-saver is Bob Markle's PT-06A electronic speed controller for motors rated up to 75 watts. It weighs less than half an ounce, requires no heat sink and delivers almost 99 percent efficiency. With one of these aboard your model, you get fully proportional motor control from zero rpm to full speed, and essentially all of your battery's power is used to propel your airplane. Regardless of the setting, virtually no power is wasted due to heat build-up.

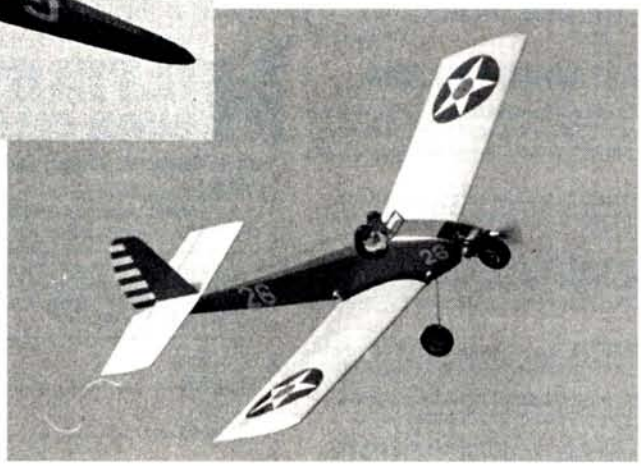


Tiny but potent, the RJM PT-06A electronic speed controller doesn't need a heat sink, and it can be fitted anywhere within a small electric R/C.

The thumbnail-size PT-06A usually sells for $65, but if you mention this column when you order, Bob will sell you one for $53, postpaid. Contact Bob Markle, c/o RJM Systems, Unit #3, Sandy Hill Rd., R.D. 6, Irwin, PA 15642.



Left: a magnificent deHavilland Comet by Keith Shaw of Ann Arbor, MI, in action. Multi-motor electric projects are easily worked out with Ken Myers' computer program.
Below: from Brookfield, OH: Bob Reid's Randy Randolph-designed Bee-Tween is powered by a glow ½A, but a 30 to 50W motor would work just as well.



**Here are the addresses of the companies featured in this article:*
***Peck Polymers**, P.O. Box 710399, Santee, CA 92072.*
***HiLine**, P.O. Box 11558, Goldsboro, NC 27532.*
***Graupner**; distributed by Hobby Lobby Int'l; 5614 Franklin Pike Cir., Brentwood, TN 37027.*
***Idealair Models**, P.O. Box 44853, Detroit, MI 48244.*
***Sure Flite Enterprises**, 571 Crane St., Bldg. H, Lake Elsinore, CA 92530.*
***Ken Myers**, 1911 Bradshaw Ct., Walled Lake, MI 48390.*

HOW TO

FAST, CLEAN AND DURABLE

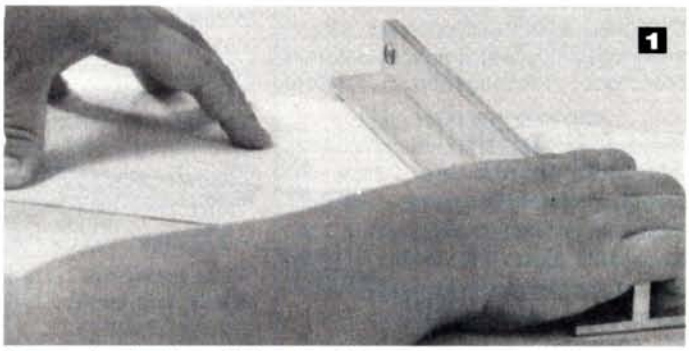
Skin Foam Wings Using Transfer Tape

by JEF RASKIN

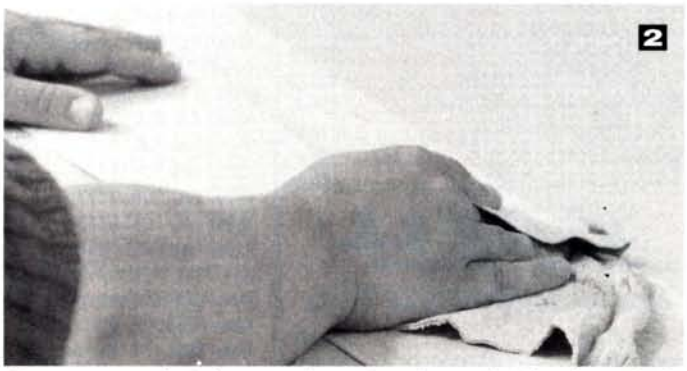
FOAM-CORE wings skinned with balsa, obechi, or other wood-based materials are widely used. The wing skins can be applied with white glue, epoxy, transfer tape, or odorless CA—in order of increasing expense. Of these methods, the neatest, quickest and easiest is transfer tape. If done correctly and with the correct tape, it results in a long-lasting, handsome job, fully the equal of any other method. The author has some wings done this way that have been flying aerobatics for seven years with nary a wrinkle or loose spot.

There are two basic kinds of transfer tape. First, the kind which, after you've peeled off the cover, leaves a thin film of plastic coated on both sides with adhesive. This is the wrong kind. Then there is transfer tape such as that available from art supply stores and Cheetah Models*; it leaves a very thin film of glue with no backing at all. This is the right kind.

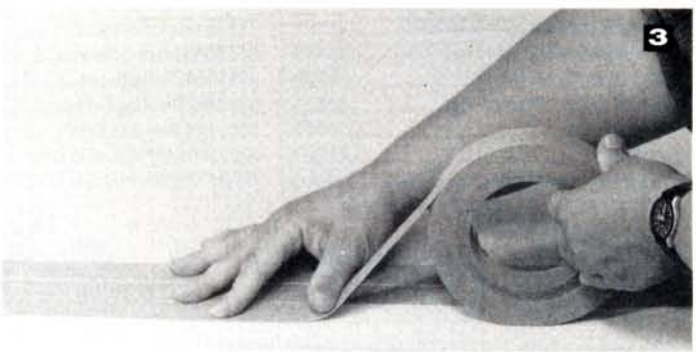
**Here are the addresses of the manufacturers mentioned in this article:*
***Cheetah Models**, 14725 Bessemer St. #B, Van Nuys, CA 91411.*
***Sig Mfg. Co.**, 401 S. Front St., Montezuma, IA 50171.*
***Midwest Products Co. Inc.**, 400 S. Indiana St., P.O. Box 564, Hobart, IN 46342.*
***Perma-Grit**; distributed by D.G. Products Co., 1302 Berwin Ave., Dayton, OH 45429.*



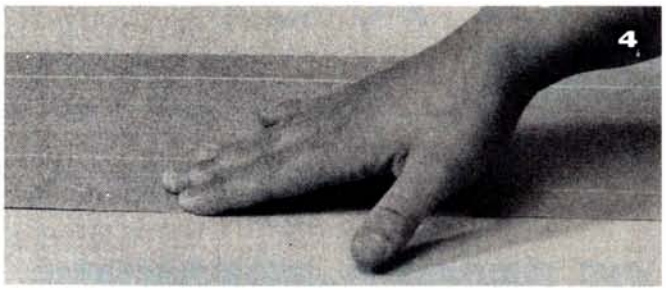
Prepare the sheeting to fit the wing with some overlap on all sides. Balsa in wide widths from companies like Sig* and Midwest* can ease the joining chore. This process also works with obechi and plywood. A light sanding on wooden materials, as shown, will assure you of a fresh surface to which the tape can adhere.



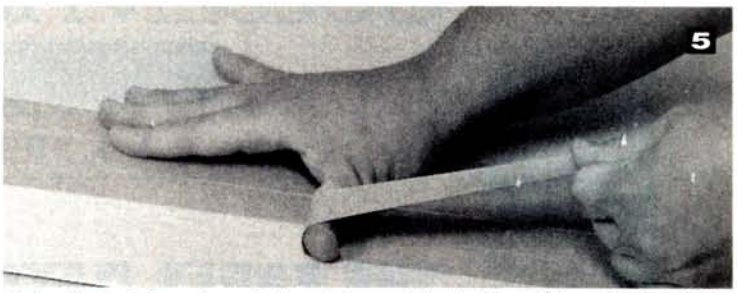
Use a vacuum and a tack-rag, as shown, to make sure that there is no plastic or wood dust on the surfaces to be joined.



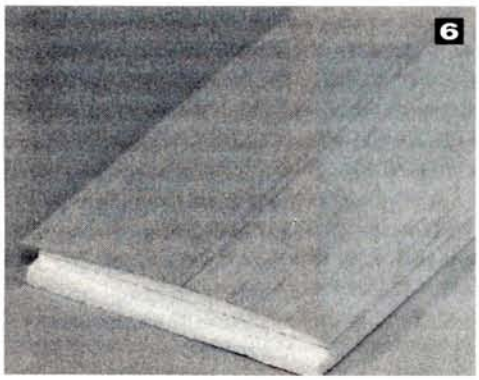
Apply the tape to the wood, not to the foam-core. Press it down thoroughly. Small spaces (1/16 inch or so) between the tape strips are OK.



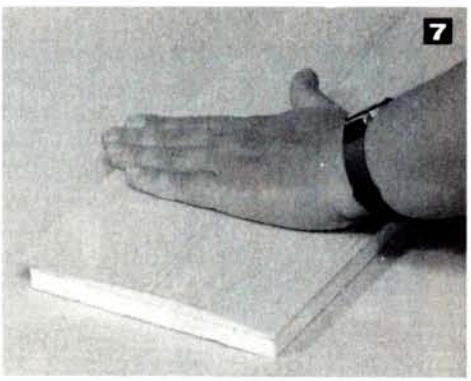
Forcefully press the tape onto the wood. As each strip is applied, cut off the ends that extend past the sheeting material.



Using the technique shown in the photo, peel the backing off the adhesive. If the adhesive tries to come up with the tape, press more firmly.

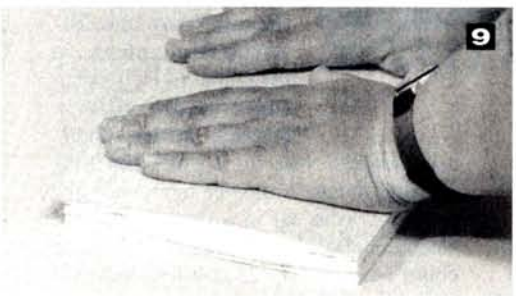


With the foam-core in its saddle with the bottom facing upward, working on a perfectly flat surface, carefully lay the sheeting on the core. If you miss, you won't get a second chance, so line things up properly.

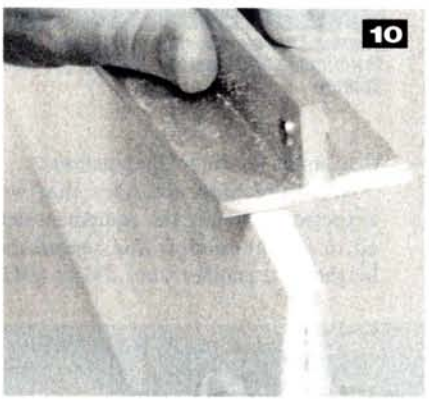


Starting in the center and working in the direction of the grain (if you are using wood), firmly press the skin onto the foam. Work toward the outside until the skin is firmly attached.

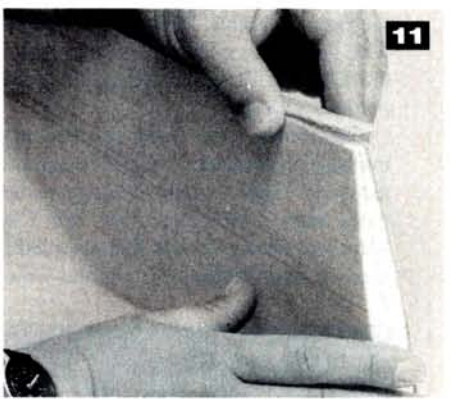
Using a tool appropriate for the skin material you are using, trim off the excess.



If you are covering a core that goes all the way to the pointed trailing edge of the wing, place a strip of 1/64-inch ply or 0.007-inch carbon tape on the lower trailing-edge covering sheet where it extends beyond the trailing edge of the core. This will allow you to sand the trailing edge to a dead-straight, knife-like sharpness. The wing shown in the photo uses a separate aileron. Now apply the upper wing skin as you did the lower.



Use a sanding block to make the leading edge flat and the trailing edge flat or pointed as required by your model.



Sometimes, you can use the trimmed-off excess to cover the portion of the wing to which the aileron will be attached.

Far left: use a "sandable" glue to attach the leading edge to the covered core. Rubber bands are handy for holding the leading edge on while the glue sets.

Left: a sanding block is best for rounding the leading edge. Gluing on the wingtips and sanding them in finishes the wing structure.

GOLDEN AGE OF R/C

HAL DeBOLT

THE EARLY DAYS OF RECORD-BREAKING

LAST MONTH, I filled you in on Maynard Hill's FAI world records. Now, I'll tell you how record breaking started in the USA. Of course, a lot of preparation and special equipment is necessary; you obviously don't just go out to the flying field and say "Hey, Joe, give me a hand, will you? I want to set a world record."

LET THE TRIALS COMMENCE

In '63, Maynard returned from England and saw an opportunity for his Washington D.C. R/C club to add a new dimension to its annual Fourth of July R/C extravaganza. The members planned to add two days of record trials to this event. Event director George Wells quickly realized that out of all the possible records, altitude and speed would best fit the D.C. R/C facilities. Many members were interested in record trials in one of the two categories. With the AMA's help with the oodles of paperwork required by the FAI, the first U.S. record trials were put into high gear.

Obviously, you need equipment to measure performances. Speed is easiest to measure. Highly visible orange-painted poles marked the course, and Don Clark borrowed timing devices that recorded the runs in hundredths of a second—more than ample for the FAI regulations.

Charles Chomos' oversize LW Trainer. It was built to be flown with the Vintage R/C Society. Charlie got into R/C in the '50s with a Trainer.

With the high altitudes that were expected, obtaining the equipment needed to fly the models and record their heights was another story. Flight tests of Maynard Hill's model indicated that the maximum altitude at which a model could be seen with the naked eye was only 5,000 feet. Luckily, the U.S. Navy provided the use of the Weapons Laboratory in Dahlgren, VA, including its sophisticated tracking and vision-enhancement equipment.

It was a two-man vision-enhancement system. One man followed the plane with radar. An aluminum-foil patch on the model provided reflection, and the operator had 20-power binoculars. In turn, the radar device (used by the military to track artillery shells and bombs) was on a platform that included huge, 72-power binoculars for the pilot, who sat in a reclining chair. Theoretically, with this system, a plane could reach nearly 25,000 feet and still be seen!

With a 78-inch wingspan, Charles Chomos' Trainer is about one and a half times the size of the original. Powered by an Irvine .40 diesel, this 7¼-pound model can duplicate the original's flight to a "T." The transmitter that looks like a Bramco is Charlie's own concoction—still on 27MHz!

REMARKABLE RECORDS

So, how did it go? Four pilots attempted altitude records. Howard McEntee, Walt Good and Bill Northrup each topped the Russian record. Maynard, however, nearly doubled the Russian record with the best flight of the day—13,320 feet! Maynard's model had a 7½-foot wingspan, and it was powered by a stock Fox .59 engine and guided by a Sampey 404 R/C system. Considering the changes in atmospheric pressure and temperature at that altitude, it's remarkable that the engine kept running without any special fuel system. A much more sophisticated model would be needed to reach greater heights, though. The current record is above 26,000 feet. I wonder how *that*

(Continued on page 34)

OT R/C OVERSEAS

Geoff Goldsmith of Surrey, England, gave us a fine report on a recent gathering of his OT R/C group. He tells us that this gathering, which was organized by the Franklin brothers, brought together the "who's who" of OT R/C in England. Some flew planes in the early single-channel days (similar to our VR/CS Selingsgrove meetings?). The notables who were present included Doug Spreng, who now lives in England; Harry Brooks, who tied Tom Brett for the second world championship (even though thousands of points were involved); and Frank Van den Burgh, who was a prominent member of the first world championship team.

Many notables attended the '92 English OT R/C meeting. Doug Spreng (left) makes with the sticks on Geoff Goldsmith's Astro Hog while Geoff (center) stands by. Co-world champ Harry Brooks critiques. Note the very short 465 antenna. Inset: Geoff Goldsmith's 14-year-old Astro Hog still flies. Geoff built his first Hog in 1958! The Orbit transmitter was for nostalgia and laughs.

In the photo, Doug is flying Geoff's 14-year-old Astro Hog. Is this a déjà vu for him? Geoff built his first Astro Hog in 1958! Initially, this plane had an O.S. 60 FS engine, but it now has an English Laser .75 FS. Old birds just fly on.

Geoff uses an English-made propo R/C system. No big deal, you say? How about the fact that it's run on 465MHz? Though 465 is also legal in England, 35 is more popular. Consequently, Geoff usually operates on an "exclusive frequency." He says the system works well. Many of us got started with C-S 465 single-channel systems. They were a godsend for people who didn't understand electronics! I wonder why our manufacturers never exploited 465 further?

It's good to see that OT R/C is alive and well, worldwide!

was accomplished?

The speed record of that time—123.6mph—was set by Bob Dunham and Jack Bentley, but we don't have any information on how they achieved it. Can anyone fill us in?

The only D.C. R/C member who was prepared for a record speed attempt was Bob Scott, who was addicted to pattern and pylon flying. Scott used one of the hottest pylon racers of that day—Bob Baldwin's Delta Hustler. The Hustler was usually powered by a .19 engine. With the aid of engine guru Don Jehlik, for the record attempt, Scott repowered his Hustler with a racing McCoy .60. The combination proved successful, and Scott set a new R/C speed record of 126.9mph.

A major obstacle with the speed runs was the low passing altitude that the rules required—16 feet minimum and 32 feet maximum! Also, in the specified time, a "winning" speed had to be recorded in both directions over the course. Bob did well!

It's strange that today's speed record is only a little more than 200mph, even though we have many .40-powered Formula 1 pylon racers who record times of over 150mph on the pylon course; they must *easily* push 200mph on the straights. It doesn't seem too difficult to use present-day technology to set a new record.

Any club can add record-making to its agenda. The D.C. R/C club enjoyed it, why not others? The AMA will gladly help out.

MOVING ON

There are other aspects of the R/C Golden Age that we shouldn't neglect. One is that OT enthusiasts often like the idea of or the look of a particular OTer, but not its size. By definition, a replica *is* smaller than the original! Isn't the objective to duplicate appearance and flight? This isn't a scale event by any means! A few years ago, Norm Rosenstock doubled the size of the LW Trainer and reported excellent results. He even sold its plans.

Recalling his first R/C experience with his Trainer in the '50s, Charles Chomos of Burlington, Ontario, Canada—a Vintage R/C Society member—wanted an OTer. He had fond memories of the Trainer, but the .09-powered model imposed restrictions. A larger plane would be more versatile. His answer was to scale the original 48-inch Trainer up to 78 inches, and as the photos show, the result is exemplary! Charles's "big one" weighs 7¾ pounds, is powered by an Irvine .40 diesel (original Trainers were often powered by Mills .08 diesels) and flies realistically. It's a perfect scaled-up version of the smaller one.

The radio that Charlie used is even more interesting. He had a defunct Bramco system on hand. He took it apart and replaced the inoperative Bramco components, and for his Trainer, he came up with a 3-channel system that looks like a Bramco. Still flying on 27mHz, he says that with 2 watts of transmitter power, he doesn't need a modern radio. Enlarging the Trainer was a labor of love, but can you imagine the additional effort the radio took? Great job, Charlie!

Flash! If you haven't heard, on October 1, 2, and 3, 1992, Maynard raised the endurance record to 33½ hours! Good show, Maynard!

Remember, this is your OT R/C place!

Bob Fiorenze's replacement for his Playboy Bunny F4J Phantom is this Playboy Bunny F-14A Tomcat. The crowd's reaction to the big jet was remarkable, especially when the wings were extended and swept on subsequent passes.

Some part of the Carl Spurlock Byro-fleet was airborne throughout the meet. The single-engine F/A-18 Hornet flew impressively.

Saturday's lunchtime crowd really enjoyed a close look at the airplanes.

What else would you expect at an event held in General Dynamics' backyard?—a couple of generations of its airplanes, of course. Falcons by Caudle, Schafer and Violett line up with McCauley's Hustler.

Drag chute deployed, Bob Fiorenze's F-117 Blackhawk taxies back to the pits. The plane was clocked at over 120mph—very respectable, considering its unorthodox inlets and slit-type exhaust nozzles.

Right: a brand-new Convair B-58 Hustler by the Lynn McCauley/Butch Sichels/Charlie Fondon team. This version incorporates lessons learned from the first version which, unfortunately, crashed just prior to the '91 SWFF. A true labor of love (with some masochistic undertones).

Nine-year-old Daniel Ligon is a promising flier and a year younger than the Byron MiG-15 he flew. This model was at the first SWFF 10 years ago!

Above: Dennis Lott chose Blue Angels markings for his Yellow Aircraft F/A-18 Hornet. Two O.S. 91s coupled to Dynamax fans provide the power. Vastly increased engine reliability now makes large twins practical.

Right: Lowell Wexler calls his JMP F4J "The Great Pumpkin" for obvious reasons. Its colorful, highly visible scheme duplicates that of a full-scale Naval Missile Center test airplane.

A decade of FANtasia

PHOTOS BY RICH URAVITCH

10TH ANNIVERSARY

Southwest FAN FLY

RETURN WITH US now to those thrilling days of yesteryear, to the tumbling tumbleweeds of Texas, to the sleepy town of Lockhart, located just south of Austin, the capital. T'was here, a decade ago, that a handful—well, maybe two handfuls—of ardent Texas modelers decided that it was time to put R/C ducted-fan modeling on the map. After they had found a map and decided on a definition of ducted fans, they put together a plan for the gathering. I had the privilege of being invited to that event and to every one since then.

Before I get into what took place this past September at the 10th anniversary of the event, I'll recall for you some of the things that I observed at the first fan fly. The engine of choice was the K&B 7.5, (that's 7.5, not .75), which is about .46 in displacement. It was most often used with the Jet Hangar Hobbies Turbax I fan unit. (Tom Cook's dazzling F-4 Phantom used this setup.) Even then, the search for more power was underway, and the Turbax III was installed in one of Larry Wolfe's airframes that was driven by a Rossi .65. I described the power then as "awesome," and it was. Many products from Byron Originals were on hand, including the Byro-jet fan unit and a MiG-15. The Byron F-16s provided a firsthand look at the stable flying qualities we had come to appreciate from the type.

The nitro content of the fuel varied, but it rarely dropped below 20 percent, and plug life was frequently measured in "ones and twos"—one flight, two minutes. Although noise wasn't an issue, it was a concern. These were jet models! Weren't they supposed to be noisy, piercing and sometimes obnoxious; after all, what price performance? Besides, there really wasn't much danger of awakening the dozen or so residents of Lockhart who lived a considerable distance from the flying site. Two fans, two or three dedicated fan engines and about a dozen production-level airframes; that's the way it was.

by RICH URAVITCH

Just a few years ago, a photo like this of the real F-117 could have been worth a great deal of money—and probably trouble! Bob Fiorenze flew the angular bird throughout the event.

It doesn't get much more realistic than this! Gus Hudson's Bob Violett Models T-33 on final. The first of the "giant jets" to hit the street, it was IMAA-legal and a great flier!

Revisiting Lockhart after 10 years was like Alice going through the looking glass. A lot of changes had taken place: the town was larger, and the airport had been expanded and upgraded. Motels and eateries dotted what were once open fields. For three days last September, the sky (and occasionally the terrain) around Lockhart was assaulted by 148 ducted-fan models that were flown by 86 R/Cers in what might just have been the largest gathering of fan fliers in the region, if not the country!

The Austin and Lockhart R/C clubs joined forces under the direction of Rick Schafer and Mike Kulczyk to ensure that the event went smoothly. Working with the support of the Lockhart city administration and local businesses, the group secured the use of the airport for the weekend, arranged for the multiple-pass flybys of four full-scale F-16s from nearby Carswell AFB and invited a group of adventurous skydivers to "drop in." The local people seemed to love all the activity, as did the modelers.

You have to get up close and personal with Jerry Caudle's Toledo '92 "Best of Show" F-16 to appreciate the detail. He actually risks flying it, too!

The fun-fly format remains one of the favorite reasons for attending—no pressure, no schedule, no scores, no points. When your frequency becomes available, you can fly if you want. If you happen to be talking to experts like Tom Cook or Bob Violett about their new T-33s, you simply pass to the next person. If, like me, you didn't bring an airplane and happened to be talking to Bob's charming daughters, Marcia and Patti, about the "Boot-Scootin' Boogie" or the "Achey, Breaky," who cares?! You're here to have fun, remember?

A DECADE OF PROGRESS

Wandering through the pits and standing on the flight line invite comparisons of what has changed in 10 years. Remember the performance we all searched for so desperately using high nitro and any other speed tricks we knew? Well remember, too, that performance has different definitions! Speed?—all you want. Joe Rapolowski blasted his Violett Viper through the speed traps at 218mph! Enough people went over 190mph for it to be considered routine. All this on 10-percent-(or less) nitro

Why is this trio of "gentlemen" so happy? Bob Violett (center) has just been presented the M.A.N. "Jet Blast" Technical Achievement Award from your's truly (left) while capable and affable Event Director Rick Schafer is propably glad it's all over...until next year!!

HOLEY INLETS, BATMAN

All the advances made in ducted-fan models, including phenomenally powerful engines, composite airframes, high-tech fan units and sophisticated accessories, might raise the question of what we should expect in the future. One person who's responsible for much of what we now have to choose from is Bob Violett. In addition to pioneering the use of carbon-fiber materials in his fiberglass airframes, Bob has also introduced a line of sport jets and scale models, the quality of which is recognized worldwide. Add to the list the Viojett fan unit and the KBV engines, and you get some idea of just how committed to ducted-fan modeling Bob is.

Noise has always been a concern to R/Cers. It has caused the loss of flying sites and generated more negative attention than perhaps any other problem in our hobby. Jets draw a disproportionate amount of this attention simply because they're jets. The perception is that they're noisier, but this is debatable.

While many manufacturers address the noise

Designed and built by Lynn McCauley, this F-104 Starfighter has had its share of "teething problems," which have been worked out by scale veteran Lee Rice. Word is that Lee likes flying it so much that he's preparing a new one for Top Gun '93.

fuel and with airplanes that were just as at home loafing around at 40mph!

Speed, however, isn't the only performance parameter to be considered. For many jet modelers, the desire for more scale-like flight is now overtaking pure speed. Evidence of this trend abounded at this meet, with more and more of the larger, less rocket-like models in attendance. The 80-inch T-33s from Bob Violett and Tom Cook, the F/A-18 and F-20 from Byron, the A-7 from ETA Models, even the new Yellow Aircraft F-117, all represent this new wave of larger jets. Supplementing these production models are the efforts of scratch-builders like Mike Kulczyk with his Thunderjet, Dick Rutkosky with his large F-86 Sabre and Carl Spurlock with his up-sized A-7D. These larger models appear to have top speeds around 125mph, which makes them much easier and more enjoyable to fly in a convincing, non-ballistic manner. Sport fliers who want to get involved with ducted fans will really appreciate what the larger jets will mean in removing some of the intimidation factor.

Randy Ritch is firing-up his Texas Turbo. This pre-built sport jet has a ready-to-cover airframe, and it sells for less than $225!

One of the reasons why we can now realistically think "big" jets, however, is that significant gains have been made in engine size, efficiency and horsepower output. Remarkably, all these gains were made with very little, if any, compromise in reliability. Watching some of these airplanes perform flight after flight with few flameouts and the inevitable dead-stick landings is a clear indication of what has been accomplished over 10 years and the tremendous progress that has been made in ducted-fan modeling.

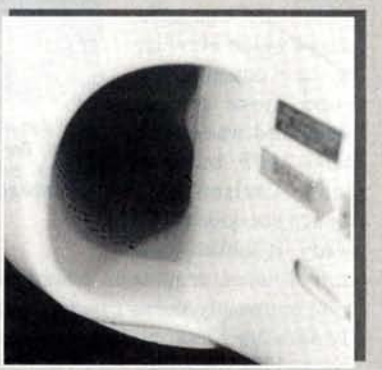
Flying, which was almost nonstop for three days, was interrupted about midday on Saturday and Sunday for lunchtime demonstrations that included outstanding R/C flying by world-class heli ace Curtis Youngblood. This young man is truly amazing to watch. Bob Fiorenze and I concluded that we wouldn't be able to move the sticks to produce the results he was getting! How about a backward rolling circle? Or taking off, pitching over inverted and climbing away from yourself? After watching Curtis's demonstration, I decided to stick with fixed wing since I can at least fly that reasonably well. Then along came Todd Blose with his big, gas-powered Extra. His demonstration almost convinced me to confine my modeling activities to writing about them! I see Todd as a future TOC competitor!

Some of the things that many of us had only dreamed about 10 years ago have become realities. Among the more outstanding exam-

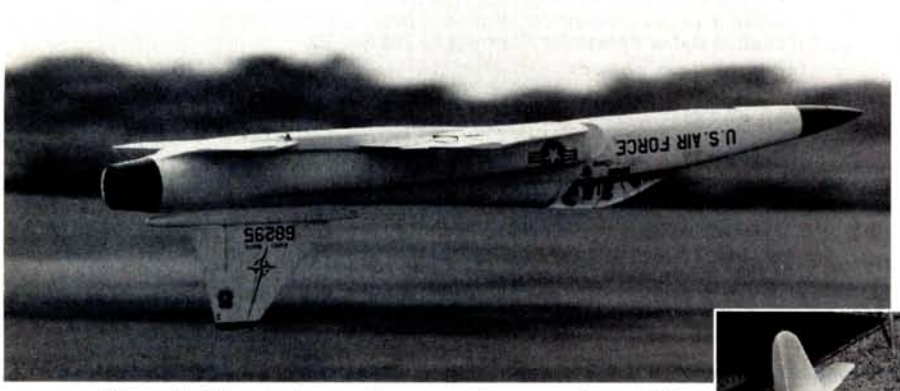
issue with lots of lip service and little action, Bob has chosen to focus on the problem and do something about it. First came the Whisper Pipe—a performance exhaust system that not only enhances the engine's output but also significantly reduces its noise level. Recognizing that not all the noise was being generated by the engine, Bob enlisted the services of an acoustical engineer to see whether anything could be done on the airframe, specifically the inlets. The results of that study appeared on the Maverick, which Bob brought to the Southwest Fan Fly. Close examination revealed a series of carefully placed holes of specific sizes throughout the front portion of the inlet duct. The area between the duct and the fuselage skin in the area of the holes was filled with a sound-damping material, which was installed while the model is being built. Does it work? Sure seems to.

Though no instrumentation was available at the fan fly to measure the actual dB level, the Maverick was noticeably quieter in flight throughout the speed and rpm range. Bob claims that a drop of three to four decibels is typical, and he plans to make the information and material available to other modelers.

In the past, the annual *Model Airplane News* Technical Achievement Award has been presented to individuals for their unique airplanes. This year, I was proud to present the award to Bob. He has made significant contributions toward solving the sound problem and by doing so, he has helped many ducted-fan enthusiasts.



Look closely and you'll see the series of holes in the inlet of the BVM Maverick. This "acoustical treatment" developed by Violett helps to reduce inlet noise, and it can be used with nearly any ducted-fan model.



Above: Carl Spurlock was airborne nearly every minute of the meet—sometimes upright; more often than not, inverted. His fleet of Byron airplanes included this F-20 painted to resemble a T-38 Talon.

Right: the Korean-war-era F-84G Thunderjet was Mike Kulczyk's entry into the large jet arena. Classic lines and generous areas made for scale-like performance. Kulczyk's BD-10 is in the background.

Above: the 24-pound, 84-inch-long, wing-swingin' Panavia Tornado, which was built from an Italian kit by Lynn Stevens, had its maiden flight at the fan fly. The twin O.S. 91 Byro-jets made it an exceptional performer.

ples was the new F-117 built and flown by Bob Fiorenze. "Fio" took turns flying the Blackhawk, his "little" F-4 Phantom, and his crowd-pleasing, swing-wing F-14 Tomcat. Remember that reliability I mentioned earlier? Bob makes it even more of a factor with his attention to detail. His willingness to help other modelers was evident when Lynn Stevens asked him to test-fly his new Panavia Tornado, a big twin equipped with wing-swing like Bob's F-14. The Tornado flew quite smoothly, and Bob remarked on its stability and easy flying qualities. Imagine: big airplanes, ducted fans, twin engines and variable wing-sweep all in 10 years!

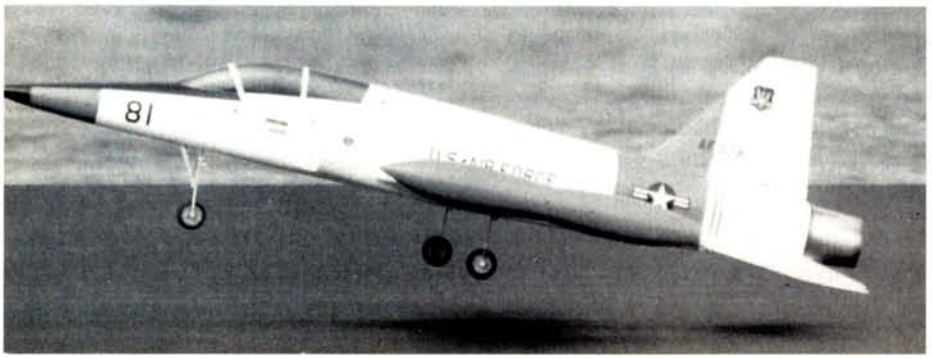
Other highlights included a brand-new B-58 Hustler designed by Lynn McCauley. The first version enjoyed a life of only two flights but apparently provided enough inspiration for Lynn and his partners to build a second one, which had onlookers shaking their heads in amazement. You can always depend on this meet to produce new, unique designs, some of which are one-offs, others which eventually see production. Beyond those already mentioned was the big MiG-21PF built by John Carlson. Although not quite flight-ready, it looked great in its Russian demo-team scheme of red (naturally!) over silver. John apparently doesn't build "hangar queens," because he was flying another neat model with great proportions, the Temco TT-1 Pinto. This proposed Navy trainer of the '50s lost out to the Rockwell T2J (North American) Buckeye. Nine-year-old Daniel Ligon could be seen skillfully burning up the skies with a Byron MiG. This in itself was exciting to see—even more so when I learned that the MiG had first been flown at the first annual SWFF. He wasn't as old as the model he was flying! That would be kind of like me flying an old Cleveland kit!

About the only thing that has been a little slow in coming to the field of ducted fans is the ARF. Wouldn't it just be great to open the box containing an EZ or another almost-ready-to-fly and see a decorated F-4 that was just hours away from the flying field? Sure it would! Well, if Dicky Ritch has his way, a giant step forward in that area might be forthcoming. His Texas Turbo was flown by his son Randy throughout the event, but I really didn't pay much attention to it until Dicky cornered me and invited me to take a closer look. This sport jet, which has a lot of Aggressor, Starfire and Barracuda influences in its styling, will accept a variety of engine/fan combinations, and it flies as well as any of the other sport jets. It's in its final stages of refinement right now, and it might be available shortly after you read this. What makes it different? Dicky plans to offer it as an almost-ready-to-cover kit

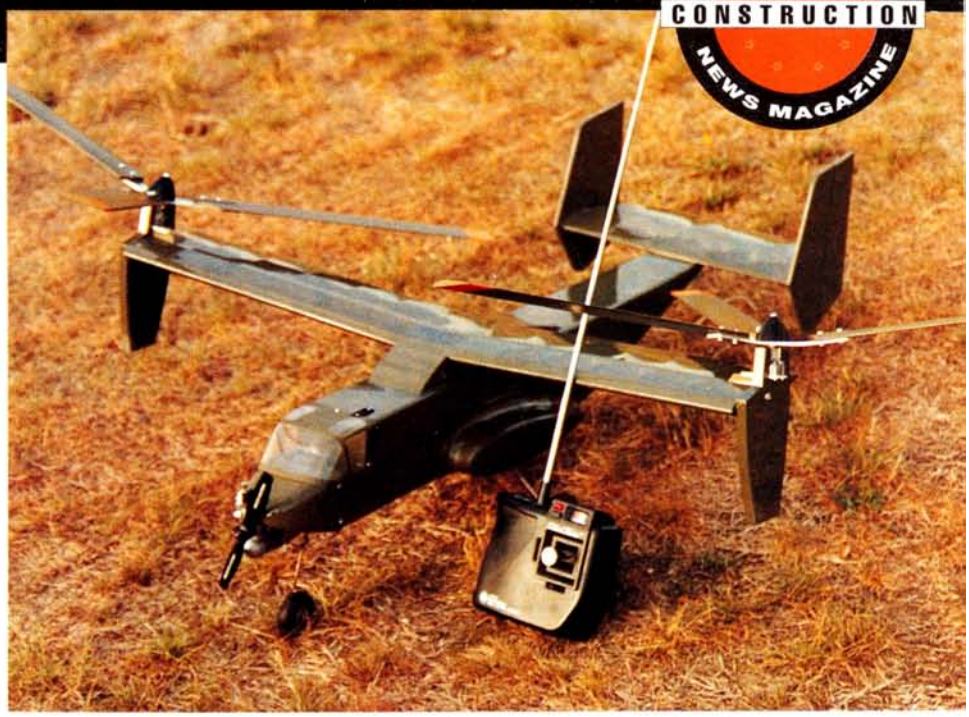
(Continued on page 85)

You can always count on some unusual subjects turning up at this event: the canards on the Saab Gripen are almost as large as the wings on the X-3 research airplane in the foreground. Unfortunately, neither was flown at the meet.

The Jet Model Products T-33 T-Bird is this close to becoming a reality. The outstanding quality of this big jet caught everyone's attention. Epoxy, Kevlar and carbon fiber are used throughout the airframe.



The new "T-38ish" Maverick jet trainer from Bob Violett Models. Flown frequently throughout the meet, the acoustical work performed on the inlet system made it noticeably quieter.



Osprey Autogyro

by ANDREW FANNING

I HAVE ALWAYS enjoyed scale models, and when I was looking for a subject for *Model Airplane News'* Design Contest, I was looking for an unusual scale! My father suggested the Osprey for a subject, and the idea sounded like a good one to me. We found an old preliminary drawing of the Osprey that looked better to me than what the full-scale Osprey had evolved into.

I found that the autogyro had unusual looks and also flight characteristics that went with them. It uses about 50 feet for takeoff (it needs this to get the rotors up to speed), then it lifts off without use of elevator. That was the first thing I had to learn. Altitude is controlled more by throttle than elevator. The thing turns well with its twin rudders—not much elevator needed here, either! What makes it such a great small-field flier is the slow air speed, and I mean slow! For landing, it doesn't need a field at all. Just fly over the landing spot, not especially low—20 to 30 feet or so—then cut the throttle. Without the pull of the engine, the Osprey stops moving forward and settles straight to the ground with a small bounce.

PHOTOS BY ANDREW FANNING

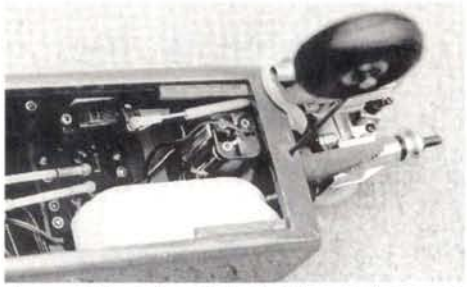
A year or so ago, I built a non-scale twin-rotor autogyro for a .35 engine, hoping to find something that could fly off the ever-shrinking and disappearing flying fields. I didn't have a lot of luck with it, but it helped a lot with the construction of the Osprey. With the first Osprey, I followed scale closely, and that is why it barely got off the ground. The second craft was what I call "stand back and squint scale." I increased the fuselage length and the wing span to get a larger rotor diameter. The tail surfaces are also much larger than scale. All this seemed to do the trick. The Osprey should be able to fly in an area as small as a softball field.

AN ODD BIRD THAT'S A LOT OF FUN

CONSTRUCTION

I used an O.S. .15 for power. It worked well, but something in the .19 to .25 range will make the weight a little less critical. I

used a Cox* 3-channel Cobra radio; it's a very nice, small package that helped to keep the plane's weight down to 41 ounces. At first look, the construction may seem a bit complex and unorthodox, but with simple construction methods and vacu-formed parts, the Osprey isn't as much work as it looks. A small band saw and a belt sander aren't absolute necessities, but they make everything a lot faster. Shaping the molding plugs for the side blisters, nose and canopy only takes a few minutes with the sander and band saw. The sander also



A view of the radio and the tank through the access hatch in the bottom of the nose.

makes the shaping of the rotor blades and wing ribs a lot faster. The covering is MonoKote with a little O.D. Pactra Formula U*. I used two .049 crankcases for the rotor bearings and one crankcase with a tank for the rotor balancer and trimmer.

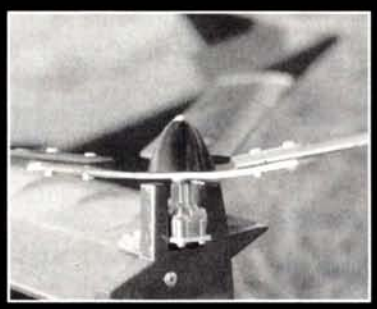
FUSELAGE

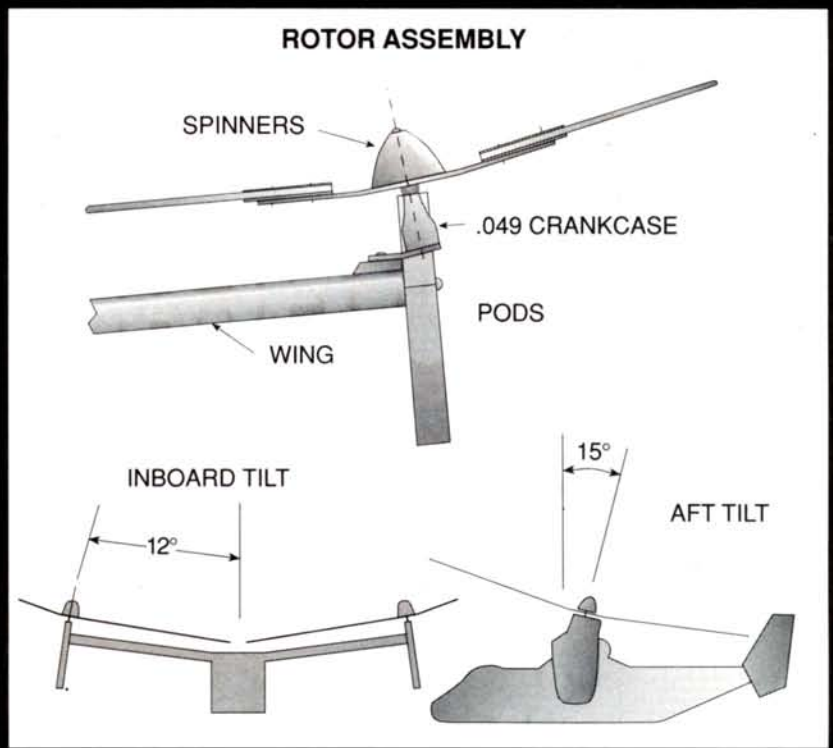
Lay the two fuselage halves on the drawing. The 3/8-inch-square stringers are made of light balsa. The 1/8-inch sheet and the 3/8x1/8-inch spares are made of medium balsa. When you install the balsa sheeting on the nose, don't forget to make a right and a left side. Then stand up the sides in place on the 1/8-inch ply firewall. After installing the main landing-gear mounting-plate, add the fuselage cross-braces from there forward. When it has dried, pull the aft sides together and attach them to the wedge, being sure to get the same amount of curve in both fuselage sides.

After filling in the rest of the braces, install the wing saddle and the rest of the sheeting. Mark and drill all the holes for the engine and fuel line before giving the fuselage one coat of paint to help seal it. Once the gear wire is bent to shape, glue it in place with epoxy and 1-inch glass-cloth tape. (This is also the way I attached the nose gear before I tried the swiveling gear attached to the engine mount; see plans.) I have found from experience that it's better to install control rods and servos in an open fuselage than in one that is covered with MonoKote. Don't forget the ply and balsa blocks for attaching the canopy and cowling.

ROTOR ASSEMBLY

With the rotor components complete, the .049 crankcases can be attached to the aluminum tabs, which are bolted to the wingtips. The tabs should have a 7-degree bend in them to give the crankcases a 12-degree inboard angle. The tabs are bolted through pine blocks on the wingtips that should also give the crankcases a 15-degree-aft angle. I use small washers to do any fine adjusting that the rotors may need, and a wood screw to attach each engine pod to the wingtips, being sure that they will not interfere with the rotors. Use the alignment tool one last time to check the rotor pitch and dihedral. This is very important, because it helps you get lift from both rotors at the same time at takeoff. Using the shaft bolts and spinners, attach the counterclockwise rotor on the right crankcase and the clockwise rotor on the left crankcase. To see that both rotors are at the same angle, it is necessary to check that the rotor tips pass over the wing center at the same angle.

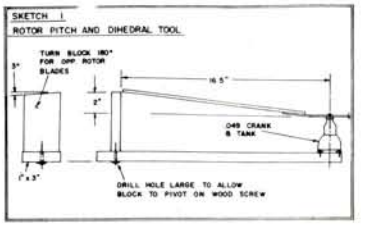


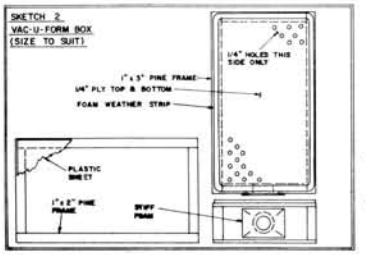


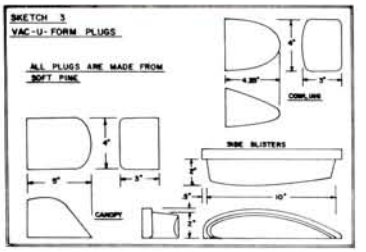
WINGS AND PODS

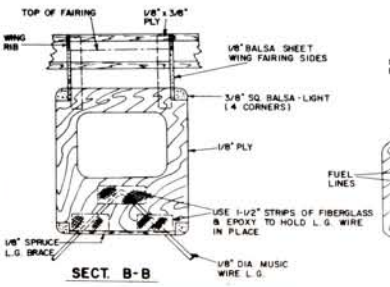
Cutting the wing ribs is fast with the band saw and sander. I just make a stack of balsa sheets with a template of the ribs on top, then cut and shape to the template. An option is to make two templates of stiff con-

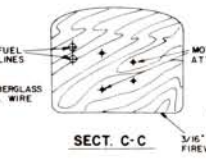
ORDER THE FULL-SIZE PLANS... PAGE 108







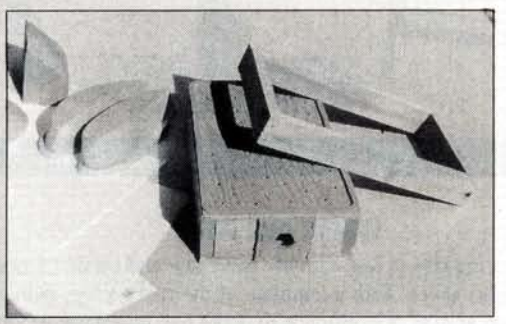




VACU-FORMING

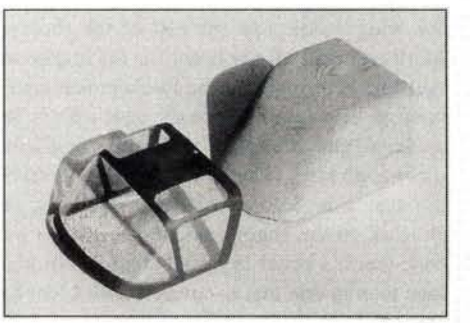
If I had known that vacu-forming was this easy, I would have tried it a long time ago. I build my box based on the size of the available plastic. Evergreen Scale Models sells .030-inch-thick white sheets, which I use for the side blisters and .060-inch-thick, which I use for the cowl. For the canopy, K&S* sells a .040-inch-thick butyrate sheet. As you can see on the plans, I use a stiff foam to seal around the hole in which the vacuum hose is placed. The sheets are stapled to the frame with the staples about 1 inch apart.

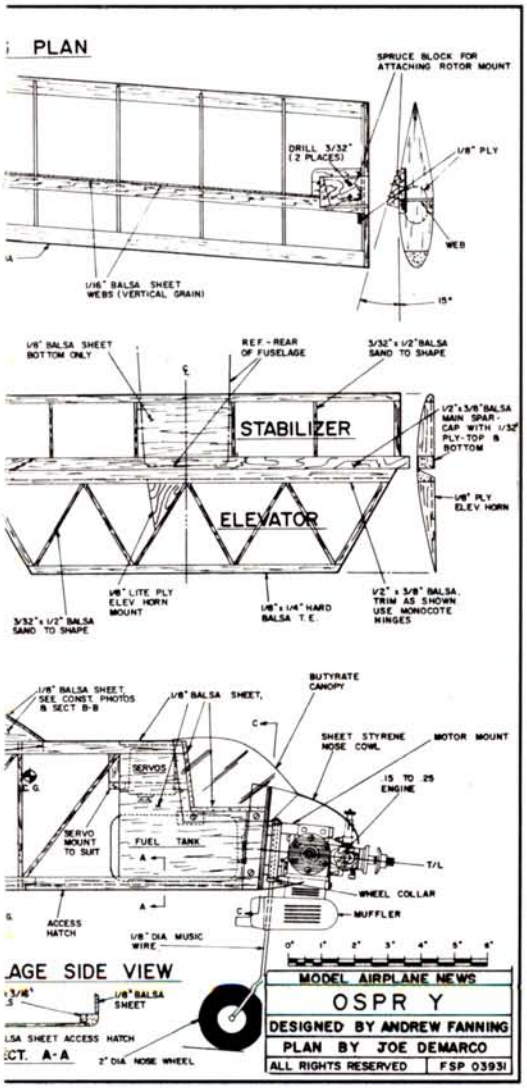
The forming blocks are larger than the part needs to be so that it can be trimmed to fit. I put the frame with the plastic side up on the second level in the oven, set it on broil and leave the door open so I can keep a close watch. As soon as the sheet begins to sag, I turn on the vacuum, then pull the frame out and press it with the plastic side down on the box. I have to hold it there for a few minutes until the plastic cools. After the parts are trimmed to fit, paint them with the O.D.

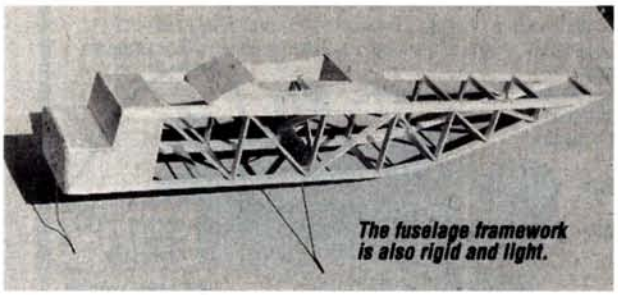


Left: vacu-forming unit and plugs. They don't have to look good; they just have to be functional.

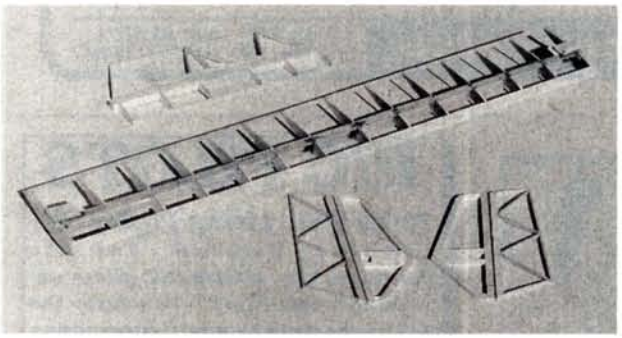
Right: The trimmed, painted canopy beside its plug.







The fuselage framework is also rigid and light.



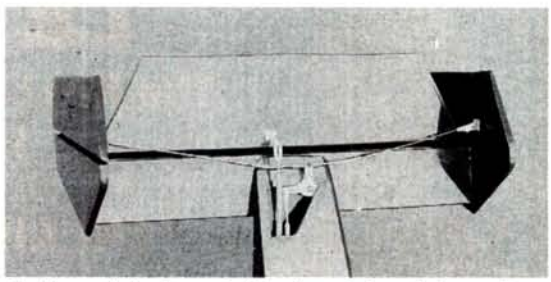
The open framework of the finished wing and tail is light and strong.

struction paper and put them on both sides of the stack of balsa sheets, then shape with a fine-tooth saw blade and a sanding block. Pin the bottom spar on the plans, and use a 1/2-inch-square scrap located at the trailing-edge position to help keep the trailing edges lined up as you glue them to the lower spar. Next, slide the trailing edge of the ribs into their slots and glue them before adding the top spar and leading edge. Using a sanding block, create the angle to give the wing dihedral. After gluing in the plywood to hold the dihedral braces in the wing, put the 1/16-inch balsa web between the top and bottom spars.

When I attach the angled rotor blocks to the wingtips, I use a little epoxy and glass cloth to hold them to the top spar and wingtip. Then I paint the blocks and bolt the aluminum brackets in place before covering the wings. It may be tempting to forget the engine pods, but they're more important than they may look. When I was test-flying the first model, I found that these pods saved a lot of rotor blades. They worked like wingtip skids to protect the rotors. The construction is simple. I just laid them up on the pattern, sanded them, and covered them with MonoKote. There was no right or left until I attached them to the wingtip with one screw, being sure to hit the ply tabs inside the wing.

TAIL SURFACES

Build the tail fins from light balsa, and sand them to shape after assembling them on the drawing. The main spar is a sandwich of balsa and 1/32-inch thin ply. I sanded the leading edges of the rudder and elevator to a sharp 45-degree angle so I could use MonoKote covering for hinges.

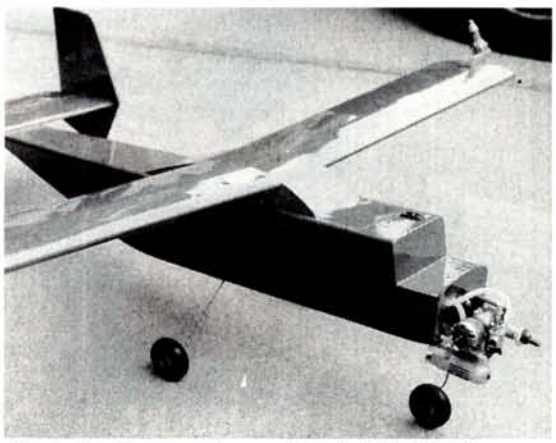


Rudder and elevator control hook-up. Only a photo can show the simplicity of the mechanics.

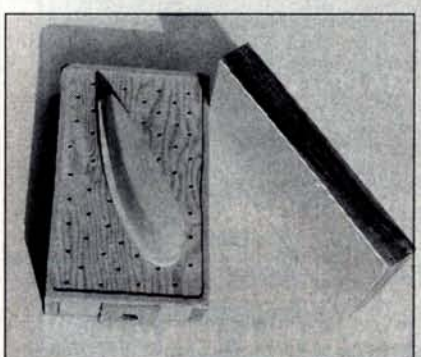
ROTORS

Use a medium balsa for the rotors. When you buy supplies for the rotors, get enough to build at least a couple of extra blades—odds are that you'll need them. After "Zapping" the pine leading edges onto the planks, set up the belt sander with a fence for the planks. I adjusted the tilt of the table on the sander, and then ran a scrap of wood to check how much to take off to get the airfoil I needed. Finish shaping with the old sanding block, and then cut all blades to the same length. Glue the thin ply on the top and bottom of each rotor at the hub attachment point. Don't

(Continued on page 85)



Here's the Osprey with everything installed but the vacuformed parts and the engine pods.



The plug for the side-blister is in place, and plastic is stapled to the frame—ready for the oven.

Pactra Formula U. I use one coat of clear to give the parts a gloss to match the MonoKote that's on the rest of the craft. The canopy is masked and painted from the inside, so the clear coat isn't necessary.

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

GREAT PLANES

F-14 TOMCAT

BOGEY AT 12 O'CLOCK HIGH

THE TOMCATS flown by Tom Cruise in the movie "Top Gun" triggered the "need for speed" in many of us. Now Great Planes* has made it possible to fill that need for a mere fraction of the cost of a ducted-fan jet. This .60-powered replica can be a real hot rod with the gear up, yet it still flies and lands like a sport-pattern plane. Great "jet," Great Planes!

THE KIT

The box itself is a work of art! The photos of the full-size Tomcat and carrier are great for the imagination. Inside, you'll find rolled plans, a separate compartment for the canopy, bagged hardware and bundled wood. The 56-page instruction booklet is well-organized and includes lots of helpful photos. Also included are preflight and flight instructions.

CONSTRUCTION

Right below the warranty on the front cover of the instruction book is this statement: "Read through this instruction book first. It contains important instructions and warnings concerning the assembly and use of this model."

My advice is read and heed! And don't be tempted to alter or modify your first F-14. This is a well-engineered kit, and by following the instructions, you'll end up with a really fine aircraft. This isn't a beginner's kit, but if you can build and fly a low-wing sport R/C airplane, you shouldn't have any problems. Also included in the kit is an extra sheet of hints. I have a few hints of my own that should help you.

First, there's a mistake in the "Other

by JIM SIMPSON

Items Required" list: the two plastic Williams Bros.* pilots needed are no. 170, not no. 171! Also, the tail feathers are made by simply gluing and shaping sheet balsa parts; just follow the instructions.

The unusual shape of the wing makes it more complicated to build, but the small tabs on the top and bottom of each rib help to ensure accuracy. I suggest you omit Step 18; cutting a semicircle in the wing sheeting serves no useful purpose.

The fuselage is best thought of as a main fuselage with a simpler fuselage structure on each side. Make sure that you glue both sides of each fuselage tab—preferably from the inside.

RETRACTS

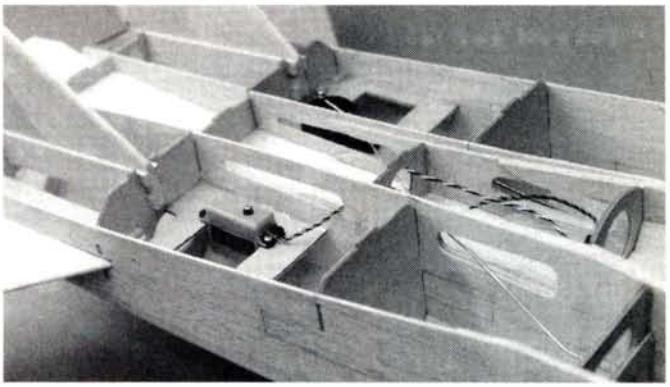
Step 3 of the retracts section shows the retract frame temporarily fitted upside-down between the mounting rails, so you can drill mounting holes using the frame as a jig. But my set wouldn't allow me to do that. I made a jig out of two pieces of scrap ⅛-inch plywood and used it as a guide to drill mounting holes for the retracts. The jig has a rectangular piece of plywood that was just wide enough to fit snugly between the rails. Glued to the top of this plywood is a square piece that's slightly larger than the outside of the retract gear frame, and it has holes drilled to match the mounting holes in the frame. It's also important to adjust and align the gear struts so that the mains are straight, and to bend the nose gear backward enough for the nose wheel to retract fully into the well.

Installing retracts isn't easy. (I've been doing it for 28 years.) This is the first setup that has worked correctly for me the first time. After I had finished the model and had run the engine, the nosegear alone retracted because the setscrew in the wheel collar that attaches the nosegear linkage to the maingear linkage apparently had vibrated loose. Be sure to use thread-locking compound.

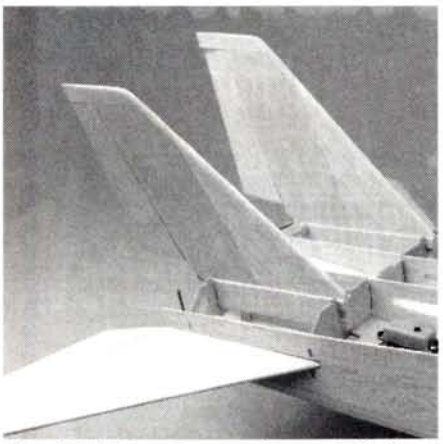
RADIO INSTALLATION

This is also the first time that I've installed all the radio equipment and the linkages before doing all the gluing and sanding. The installation as shown on the plans works very well, with one exception: I had trouble with the nose-gear steering as shown on the extra sheet of hints, so I mounted a servo-output arm on a block in the fuselage and used it as a "bellcrank" to keep the steering rod running in a straight line. (Use opposite arms to provide reverse direction.) Works really well! *[Editor's note: a current addendum to the instructions advises routing the steering linkage through a different point on the fuselage and mounting it on the opposite side of the servo wheel to reverse direction.)*

When all the linkage and radio installation has been completed, the fuselage assembly is finished by adding the tops, bottoms and corner pieces, which are then carved and sanded to shape. To ensure the fit and alignment will be correct, glue the plywood nose ring to the spinner backplate after putting spacers between them. Then bolt the backplate onto the engine. The problem here is that the nose-ring diameter is about a ¼ inch larger than the backplate, so trim it to fit before proceeding with the assembly. *(Editor's note:Great Planes intentionally built in an ⅛-inch "fudge factor" all the way around the ring so that any modeler can shape it for a perfect fit.)* Then enclose the engine compartment with balsa sheet and balsa scraps. When the glue is dry, carve and sand to shape.



The aft fuselage with the throttle servo in foreground and the retract servo in background.



The sheet-balsa empennage is mounted in die-cut slots.

FINISHING TOUCHES

After I had installed the formed-plastic exhaust nozzles, I didn't balance the plane laterally, as instructed, but I finished the sanding instead. I covered the plane with MonoKote* in the scheme that's shown on

SPECIFICATIONS

Model name: F-14 Tomcat
Manufacturer: Great Planes Model Mfg. Co.
Type: Jet-like sport /pattern
Sug. price: $179.95
Wingspan: 58¼ inches
Wing area: 628 square inches
Wing loading: 26 to 28 ounces/square foot
Weight: 7 to 7¾ pounds
Length: 51 inches
Engine used: .60 to .75 2-stroke (O.S. * .61SF for test)
No. channels req'd: 4 (or 5 with retracts)
Radio used: Kraft * 7 channel on 6 meters

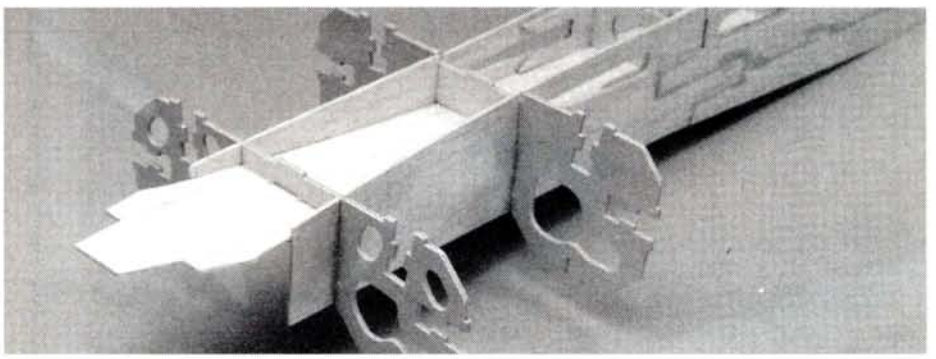
Features: symmetrical wing with built-in washout; all-wood, built-up construction; vacu-formed canopy and engine tail pipes; fixed or retractable landing gear; computer-drawn plans; illustrated check-off instruction booklet, hardware and engine mount.

Hits

- Jet-like speed with good stability
- Great interlocking parts
- Good-looking

Misses

- Instructions call for pilots that are one size too large. *[Editor's note: an addendum to the instructions now covers this.]*
- Plywood nose ring ¼ inch too large in diameter, in review kit, but was sanded to size. *[Editor's note: although the author feels this was a "miss," the designers intentionally oversized this piece to ensure that a perfect fit could be achieved.]*



Well-made die-cut parts make a difficult job easy.

FLIGHT PERFORMANCE

- **Takeoff and landing**

Several of the best pattern pilots in the Southwest were at the field when I taxied out, so took the opportunity to show off. I taxied to the runway center line and advanced the throttle very slowly while I concentrated on holding the center line. About three-quarters of the way down the runway, I eased in some up-elevator, and the Tomcat moved forward with jet-like speed. I felt the elevator stick hit the stop, and I quickly retracted the gear. The climb rate increased. Then I felt for the elevator-rate switch, and voilà—it was in low rate. I switched to high rate and, by this time, the F-14 flight speed had picked up and stabilized at fast forward. So where were the bogeys?

Landing was a piece of cake. I chose to make a long, low approach and "feel" my way down. I carried about one-quarter throttle onto final approach and slowly decreased the speed by gradually increasing up-elevator and easing the throttle back. As the plane passed over the end of the runway at an altitude of less than 6 feet, the throttle was at idle. Actual touchdown was just past the halfway point, because I was enthralled with the plane's stability and how its wing strakes worked. Apparently, the entire fuselage contributes to lift because the Tomcat lands better than an Ugly Stik.

- **High-speed performance**

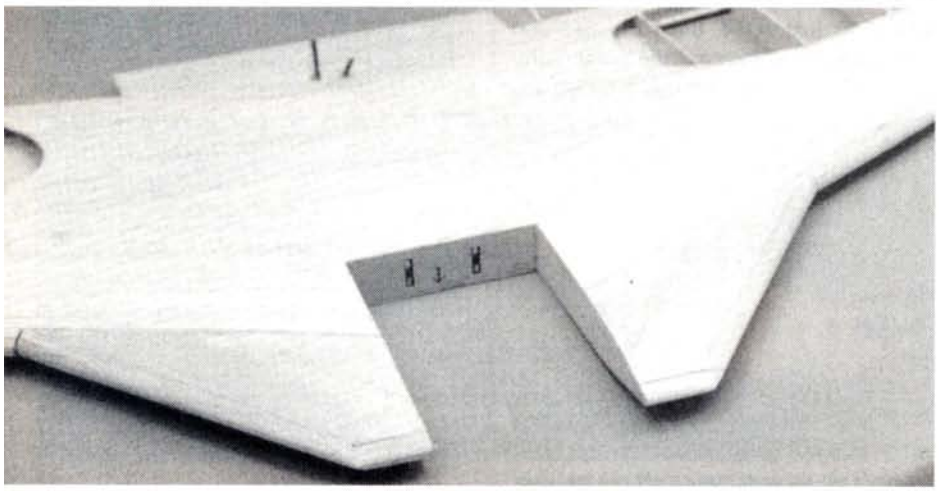
During climb-out I put in full up-elevator trim, but, at about 400 feet, after the gear hadretracted and the plane had leveled out, I had to move the elevator trim back to neutral.Once it was trimmed for level flight, the F-14 really moved. It did a 180-degree turn and continued to dive toward the field. As it passed the far end of the runway at maximumspeed, I throttled back a little and began to climb to cruise altitude. There was no flutter,and no trim changes were needed at varying speeds. The Tomcat is stable even at increased speeds.

- **Low-speed performance**

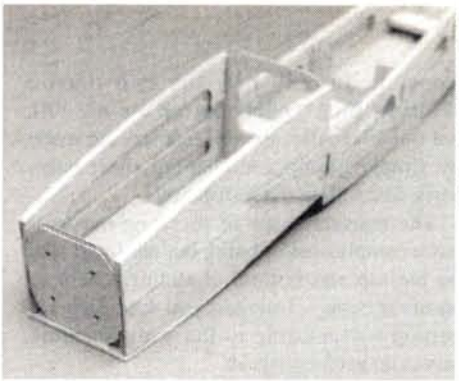
I cruised around at half throttle and made low-speed passes for the camera. Earlier, I had flown a series of horizontal figure-8s with tighter and tighter circles. There was no hint of a tip stall, but this is also related to CG position, and this plane was slightly nose-heavy (with an empty tank) at the forwardmost point (as shown on the plans). Therefore, stalls were gentle and straight ahead like those of a good pattern plane.

- **Aerobatics**

I started with loops—first, low-rate, full up-elevator; then, high-rate, full up-elevator. The Tomcat flies straight through both, and the only difference is diameter. Next were the roll series—first a single roll, low rate; then two rolls, high rate and, finally, a bunch of high-rate rolls. High-rate rolls are too fast to allow down-elevator inputs, but such is not required. It just rolls quickly as if it were flying along a wire. Rudder throw as tested wasn't enough to induce a spin, partly because the plane is slightly nose-heavy. As I get more accustomed to the Tomcat, I'll gradually decrease the nose weight and increase rudder throw to get the desired spin characteristics. Doing this will also improve snap rolls. The F-14 Tomcat is a delight to fly. It looks so realistic that it draws lots of favorable comments from observers.



The wing is an integral part of the fuselage, and both contribute to the plane's total lift.



PHOTOS BY TAYLOR COLLINS STUDIO

The fuselage consists of laminated die-cut balsa sheets and a plywood firewall and formers.

the box, then I finished it as instructed. By following the instruction manual, I found painting the exhaust nozzles easy.

I installed the cockpit and the smaller Williams Bros. plastic pilot figures. I glued the canopy on with RC-56 glue instead of CA, and I put the decals and the trim on.

"I recommend the Great Planes F-14 if you're looking for jet-like speed from a "conventional" tractor airplane"

After I had installed the radio and engine, I drilled an ⅛-inch hole on the fuselage center line immediately in front of former F-3. I then installed a large cotter pin from the bottom, bent both ends over the top of the former and epoxied it into place. When the epoxy had dried, I assembled the Tomcat and suspended it inverted by inserting the end of a straightened heavy-duty coat hanger through the eye of the cotter pin, which is right on the plane's CG! To obtain the proper CG location, I had to add nearly 2 ounces of lead shot soaked in epoxy to the inside of the engine compartment. To achieve lateral balance, I installed large sheet-metal screws in the wingtip opposite the muffler.

The all-up weight of the finished model is 7 pounds, 3 ounces. All the control surfaces moved in the correct directions, and the batteries were charged. I verified that the wing washout was correct with my trusty Robart* Incidence Meter, and I checked the radio range. I was ready for flight testing. (See sidebar.)

SOME CA TIPS

For this model, I used Satellite City* products. I started with 2-ounce bottles of Hot Stuff Original, Hot Stuff Special T and Hot Stuff Super T. All the nozzles stayed open for weeks after I had opened the bottles!

I also used Kick It accelerator when necessary. Once I had sprayed accelerator, I

(Continued on page 116)

PART 1

HOW TO

by CARL RISTEEN

A LONG HISTORY AND A CONTINUING CHALLENGE

Flutter—Causes and Cures

HAVING A PRIZED model reduced to a pile of pieces by flutter is one of the risks that bedevil R/C fliers. If you have been flying for a while, chances are that you have been bitten a time or two.

Flutter is an airflow-induced vibration of part of an airframe. Its effects may range from a barely audible buzz from part of a control surface to the violent destruction—without warning—of major portions of the airframe. The culprit is structural flexibility. When a wing flexes, the airflow pattern over it is slightly changed, and this causes a corresponding slight change in aerodynamic force. The force change tends to produce additional flex and still more force. These can act together in an evil partnership to produce progressively greater flexing until something breaks.

FLUTTER'S HISTORY

Flutter became a serious problem very early in aviation history. It resulted in many accidents before the engineers determined its cause and what to do about it.

Flutter may have cost Professor Samuel Langley his claim to the first successful, powered, heavier-than-air, man-carrying flight. His monoplane, launched from a houseboat in 1903, 10 days before the Wright Brothers' first flight, dunked the intrepid pioneer aviator into the Potomac River, in this first reported instance of flutter. The Wrights avoided this affliction by using a much stiffer, wire-braced biplane wing, and the rest, as they say, is history.

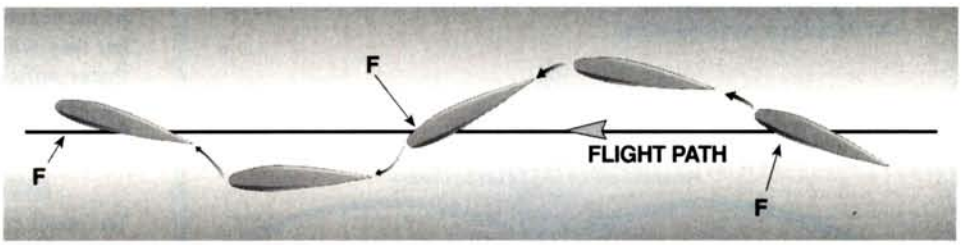
WW I biplane and triplane fighters fell victim to flutter as well, as rapidly increasing engine power drove the primitive airframes to higher and higher air speeds that tore the thin, flexible wings to pieces. Flutter has struck in the best of families, ripping the ailerons completely off one of Spitfire designer Reginald Mitchell's racing seaplanes. Tail flutter plagued the Lockheed P-38 Lightning throughout its illustrious career in WW II. Two Lockheed Electra turboprop airliners lost their wings to flutter, causing many fatalities. The engineers were chagrined to discover that they had overlooked the gyroscopic effects of the engines in their calculations. The rapidly spinning turbines resisted angular movement, just as if they had a lot more mass, and this lowered the natural frequency of the wing in tortion, which tends to promote flutter. In the early days of supersonic flight, flutter knocked the theory people for a loop, so the Lockheed engineers, in an inspired example of monkey-wrench engineering, tested many wing designs for the F-104 Starfighter by mounting model wings on rockets. High-speed motion-picture cameras on the rockets recorded the death spasms of the disintegrating wings.

FLUTTER AT THE FIELD

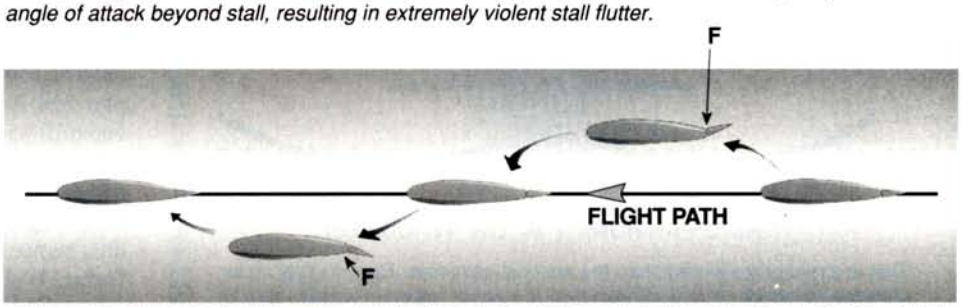
R/C fliers, if they're lucky, may hear no more than a slight buzz while a model is flying at high speed. This type of flutter is usually localized, and damage is normally confined to increased wear of the control linkage, hinges and servo gears. It can frequently be fixed by removing free play in hinges and control linkages and sealing control-surface gaps.

A more dangerous type of flutter can result in gross twisting and flexing of an entire wing or tail. (If you have ever put an open-bay, 2-meter glider into a steep dive for more than a few seconds, you have probably seen and heard full-wing flutter.) The onset can be more or less gradual with increasing air speed, or it can be extremely rapid and result in a midair breakup in considerably less than one second.

FIGURE 1



This shows the path of a wingtip in divergent flutter of a wing with no ailerons or balanced ailerons. As the wingtip angle of attack increases, the resulting lift force "F" ahead of the structural shear center twists the wing to a higher angle of attack, unstably increasing lift force. If the chordwise center of gravity is also behind the center of lift, the twist will be worsened. The wing may twist to an angle of attack beyond stall, resulting in extremely violent stall flutter.



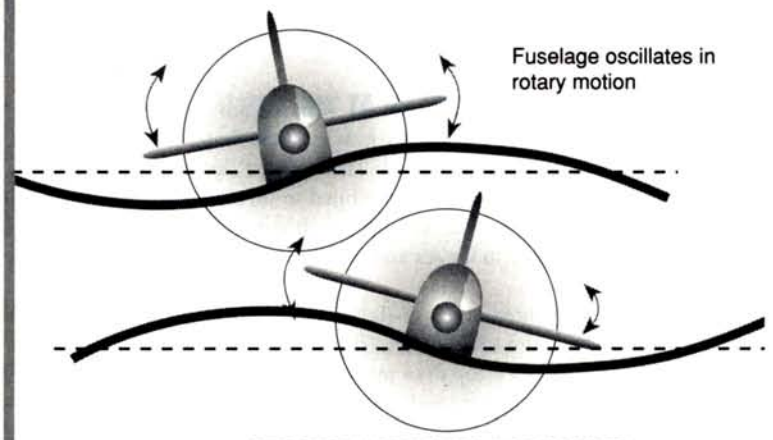
This shows the path of a wingtip in simple flutter induced by an unbalanced aileron. As the wingtip flexes up and down, the aileron lags behind because of its own inertia, producing cyclic lift force "F" that reinforces the oscillation.

FIGURE 2

Common wing flexural modes in flutter

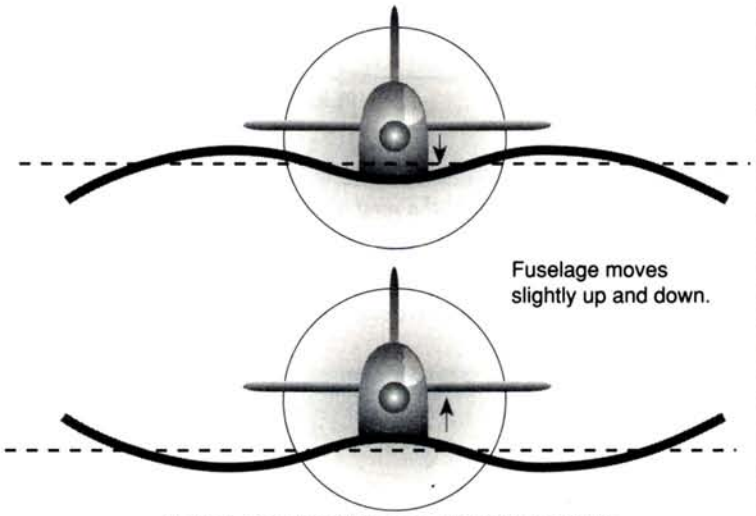
FUNDAMENTAL

This illustrates the lowest frequency and the most common flutter mode. It may be fixed by tip-mounted balancers. Note that the amplitude of the vibrations may vary from a tiny fraction of an inch to as much as several inches, depending on the stiffness or flexibility of the wing. These frequencies may affect the wing and control surfaces, or just the control surfaces.



SECOND HARMONIC ("S" CURVE)

The second harmonic is a much higher frequency than the fundamental. The wingtips move in opposition to each other. It frequently requires inboard-mounted balancers to fix, although tip-mounted balancers may do the job. An oversized tip balancer can amplify this type of vibration with disastrous consequences.



THIRD HARMONIC ("M" OR "W" CURVE)

This is a higher frequency than the second harmonic. The wingtips move together in phase. It may be fixed by the same balancer system that is used to correct the second harmonic.

FLUTTER

The fact that it can strike without warning at less than maximum speed in a model that had never misbehaved previously makes it a very insidious and puzzling thing.

FLUTTER CAN BE FLEETING

Sometimes the total duration is so short that it isn't perceived as flutter unless the model is very close to you when it happens. It can break an elevator control linkage in the blink of an eye and cause an unexplained crash. Breakage of the control linkage will frequently change the elastic and aerodynamic response of the model and stop the flutter before you notice it. In a more severe case, you may hear a bang and helplessly watch the model's wreckage rain down.

Really destructive flutter usually requires an external disturbance to get it started, such as a sharp air bump, or a series of smaller bumps spaced about right to shake the structure at one of its critical frequencies. Once a critical amplitude is reached, it accelerates very rapidly, going divergent in just a few cycles of rapidly increasing amplitude until something breaks, detuning the system. The time from onset to destruction can be less than one tenth of a second.

Practically any airframe will develop flutter if it's flown fast enough. The trick is by careful design of the airframe and use of mass control-surface dampers to move the air speed of onset well above any air speed your model will ever attain. A well-designed, damper-equipped, very light airframe will frequently withstand air speeds that would destroy a poorly designed, much more robust airframe.

When flutter occurs, cut the power immediately, and pull the nose up steeply to reduce air speed as quickly as possible to stop the flutter and minimize damage. A wise modeler will not fly the model again until a fix has been made.

Flutter that results in flexing and twisting of the wing or tail to a large amplitude can't normally be fully cured by the common fixes mentioned. Such remedies will help, but they will also tend to raise the air speed of onset of flutter sufficiently to make the flutter much more sudden and severe when it recurs. Avoiding high-speed dives may keep the beast at bay, but keep your fingers crossed.

UNBALANCED CONTROL SURFACES

The most common type of flutter encountered in R/C models is induced by unbalanced control surfaces, usually ailerons or elevators. The basic mechanism of aileron-induced wing flutter or elevator-induced tail flutter is fairly simple.

Picture a turbulent air bump suddenly flexing the wingtips upward. The statically unbalanced ailerons have mass and some torsional flexibility, as well as some free play and flexibility in their control linkage. When the wingtips suddenly accelerate upward, the ailerons lag behind slightly (owing to their own inertia) and angle down a little with respect to the wing. The lowered ailerons give the wing a little more lift, forcing it to flex a little higher, while inertia forces the ailerons down a little farther. Within a fraction of a second, the wing's structural stiffness overcomes the small aerodynamic force, and the wing rebounds, flexing back down. The ailerons

again lag behind, moving up a little, giving the wing less lift, forcing the wingtips to move down a little more, and so on (see Figure 1).

If the combination of air speed, aileron mass imbalance and wing flexural and torsional characteristics exceeds a certain value, the oscillation will self-sustain and may reach a destructive amplitude. The basic mechanism is something like pushing gently on a child's swing at just the right point in its motion; it causes the wing to go farther with each push, even though the force may be quite small. The wing has its own natural frequencies in bending and torsion, and the ailerons, moving out of phase with the vibratory motion of the wing, supply the cyclic aerodynamic force needed to sustain the oscillation.

FLUTTER COMPONENTS

Flutter, which usually consists of a combination of various degrees of twisting and bending of the surfaces involved, depends on many variables, e.g., torsional and flexural stiffness, mass distribution chordwise and spanwise, control-surface chord, structural shear center and center of pressure movement on the airfoil. It can be devilishly difficult to analyze rigorously. Some full-scale designers devote their entire careers to flutter work.

Flutter is always at one of the natural frequencies in bending or torsion. These are the frequencies at which the flying or control surfaces will vibrate if struck a gentle blow with the hand—something like plucking a guitar string. Theoretically, a wing or tail has an infinite number of natural frequencies, but only the lowest two or three are usually considered important (see Figure 2). Bending and torsional vibrations both play their parts.

STATIC BALANCING

The simplest cure for aileron-induced flutter is to statically balance the ailerons by adding a counterbalance weight ahead of the hinge line of sufficient mass to prevent the aileron from falling of its own weight when the control linkage is disconnected (see Figure 3). The mass-balanced aileron doesn't tend to flop up and down in response to wing vibration and, thus, cannot develop cyclic aerodynamic forces that would tend to reinforce the vibration.

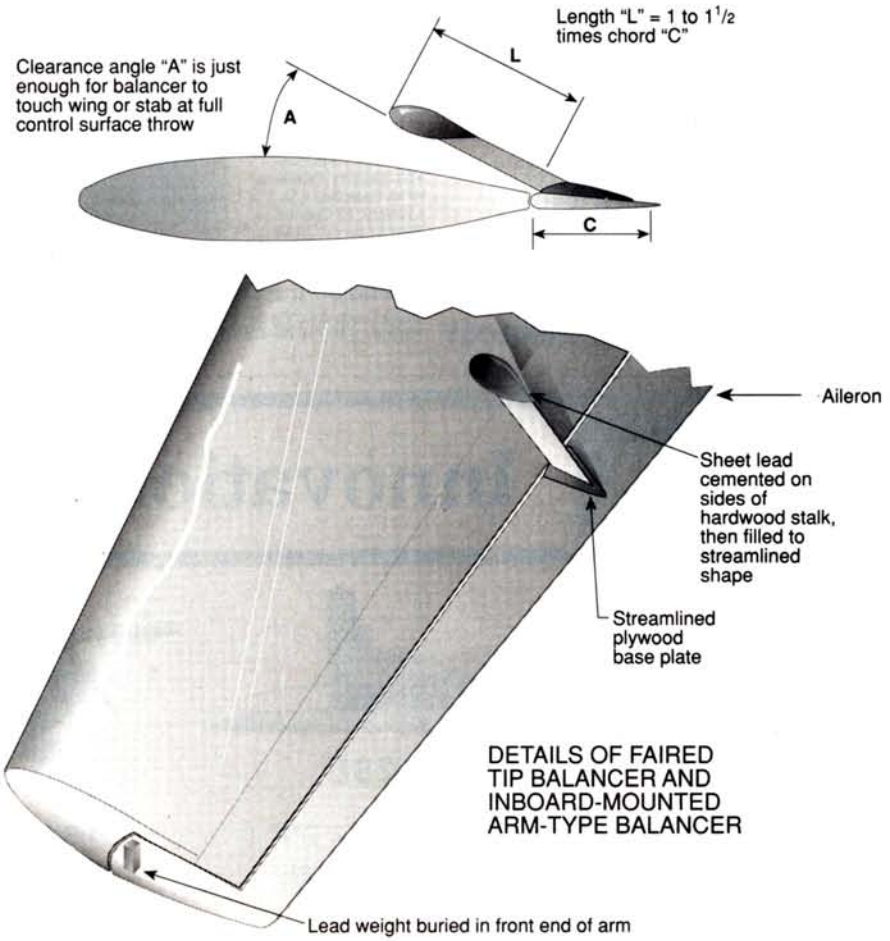
The ideal balancing system would distribute counterbalance weight along the entire length of the hinge line. This is sometimes done by moving the hinge line back from the control surface leading edge and weighting the leading edge enough to fully balance the control surface, resulting in a complicated and heavy control surface. It does provide another benefit in the form of aerodynamic force balance, which reduces the control force required. A number of weighted balancer arms that are spaced along the control-surface hinge line will provide a longer moment arm for the balance weight and help with the overall weight problem, but it will also produce an aerodynamically dirtier control surface.

TIP BALANCERS—PROS AND CONS

A single tip-mounted counterbalance—frequently called a mass balancer or mass damper—is a compromise that will cure about 95 percent of cases of aileron or elevator flutter. Rudder flutter is fairly uncommon in R/C models, but it can be cured in most cases by a similar counterbalance located at its top.

Complete static balance of torsionally flexible full-span ailerons by a single tip-mounted balancer is a very bad idea. The reason for this is that when the wing flexes up and down in flutter, the tips move up and down far more than the inboard portions of the wing, resulting in dynamic overbalancing that tends to make the ailerons move in opposition to the wing movement. At first glance, this would appear to be a good thing, as it would provide dynamic damping against vibration. The problem that arises is related to the vibratory modes of the wing, as shown in Figure 2. The most common mode is where the wingtips move up and down together, like a bird flapping its wings. There are, unfortunately, other possible modes that are associated with higher frequency harmonics.

FIGURE 3



Using excess balance weight at the tips of full-span ailerons can be very dangerous because it can work against you by exciting one of the higher-frequency vibratory modes where the inner portions of the wing panels move in the opposite direction to that of the tips (this becomes less of a problem the stiffer the wing is in proportion to its mass). A far more violent flutter that involves much more of the wing may tear it to pieces long after you thought that the problem was cured.

If a flutter problem doesn't respond satisfactorily to tip balances,

(Continued on page 136)

MADERA

WHAT DOES IT TAKE TO WIN?

The Nuts and Bolts of Unlimited Racing

by ROB WOOD

IN THE WORLD of giant-scale aviation, the Unlimited races are the proving grounds for technology. The 1991 race at Madera began a new era in miniature aircraft advancement, and the two races held since have continued to test builders, pilots and products. Airframes are getting lighter, speeds are increasing, engines are developing more horsepower, landing gear are becoming stronger and more reliable, props are becoming more efficient.

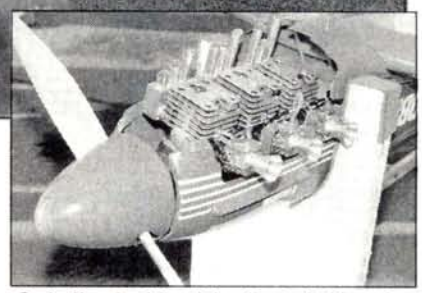
Giant-scale racing took another giant leap forward in the last week of September, '92, at Madera, CA. Sixty-six Unlimited teams were registered to compete, along with 42 At-6 Texan entries. Attrition took a huge toll, with a disturbing number of crashes before and during the races. Though it is difficult to determine with certainty the cause of a specific aircraft's demise, we can draw some general conclusions that may be useful to those who are planning to compete in any of the planned '93 Unlimited races.

The Classical Racing Team took 2nd-place silver with no. 84 in their first Unlimited racing attempt. Left to right: Ken Adlawan, Elaine Murphy, Gary Ware, Dave Marson, yours truly and pilot Bryan Keil. Standing: Monster Motors' James George. The 30 lb. Stiletto was built by Scott Broughton from Ziroli plans; Husqvarna 5.3 engine; Futaba radio; Robart retracts; APC 22 x 16 prop.

RADIO FAILURE

According to George Steiner, frequency coordinator for the '92 Madera races and AMA District 10, the radios themselves—whether FM or PCM—performed admirably in a very busy environment. Poor installations were the major cause of radio failure. "Pilots are always looking for a single cause of radio failure," Steiner said. "The truth is that the problem is almost always an accumulation of errors: metal-to-metal 'noise,' ignition, carbon fiber or metal trim near the receiver, improper placement of the antenna, null points, worn or damaged equipment and wiring. While your receiver might be able to reject any one of these interference sources with no problem, the combination overloads the radio." During radio/technical inspection at Madera '92, most of the aircraft radios that initially failed range-check were able to pass when their receiver antennas had been re-routed.

Left: Stinger Wallace (second from left) and crew make last-minute adjustments before battling Don Rice in the final Gold race. Engine flame-out in the fourth lap nixed Stinger's bid for the trophy. Said Wallace after the race: "I'll be back!"



Carla Kanak of Precision Eagle (left) assists in a trial run-up of the new Precision Triple Eagle 12.6ci engine. It was not ready for competition this year but may be a major threat in '93.

According to Steiner, speculation that some in-flight glitches were caused by signals reflecting off the metal hangars across from pylons 2 and 3 is just that—speculation. Though transmitter signals reflected off metal surfaces can cause "ghosting" (a delayed, or out-of-phase signal to the

PROPS MAKE THE WORLD GO 'ROUND

Paul Ross and Jim Miller wanted to pull their Aerrow 200S-powered Miss America through the air with all possible dispatch, as the British would say. After calculating the lift-to-drag ratio required to pull their 44-pound racer through the air at more than 170mph, they discovered that the propeller that would give the maximum power transfer from engine to airscrew didn't exist.

In this case, they were looking for a prop that was "oversquare," or greater in pitch than in diameter. Their calculations called for a 20x24 prop with a radical planform. Having enlisted the aid of full-scale-prop designer Don Westergren, who designed and built the glassed, long-grain maple prop, the team began static testing.

Custom-built 20x24 prop used on the winning Mustang (no. 00).

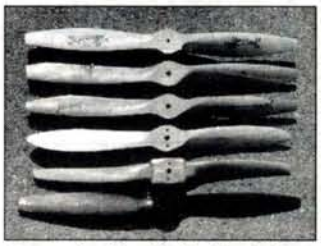
Calculations are one thing; empirical testing is another. One of the big questions was "How much does the prop 'unload' in the air?" In other words, once the aircraft has reached maximum forward velocity and the load on the propeller is at its minimum, at what rpm are the prop turning? This information is critical, because overloading the engine with too much prop robs it of power and slows it down; under-loading the engine bleeds off power and makes it run too fast. This figure can only be measured under flight conditions, and in only one of two practical ways available to most modelers:

• **Onboard telemetry.** A system such as Adaptive Engineering's* R/C Talker, which was still in the experimental stages at the time the Ross/Miller team needed it

• **Doppler-effect measurements.** After running up the rpm on the bench with a variety of small props, the team recorded the sound the engine made at the optimum operating rpm. They then flew the airplane at full throttle and videotaped the flights. The audio portion of the tape was fed into a computer and compared to the bench-test audio recordings they had made, and the prop was modified until the two sounds matched!

How successful were they? According to Paul Ross, in a shallow dive, using Chevron unleaded gas straight from the pump, the aircraft reached a speed approaching 200mph! Radar-gun measurements taken during the Gold trophy race recorded a straight and level maximum speed of 167mph.

There may be no substitute for horsepower, as the saying goes, but there's also no substitute for doing your homework.



Props in the Unlimited sizes (20x20 and up) are, for the most part, still in the testing and evaluation stages. The pits at Madera sometimes seemed like Santa's workshop, but all the elves were carving away at commercially available props, trying to customize them for a particular application. Featured are a cross-section of the major manufacturers of big bird props seen at Madera this year. From top to bottom: Zinger 20x20, PK 20x18; Carvon 20x18; Starr Aircraft 18x20; APC 19x18 (modified); Bolly 22x12.

receiver), Steiner said, there is no conclusive proof that a transmitter operating on another frequency between two metal buildings can make your receiver glitch. More testing has to be done. He offered these tips to minimize radio problems:

• Use a redundant battery and receiver system. Although most aircraft at Madera this year used at least two batteries with one-way diodes that "read" the voltage and automatically switched to the strongest battery, Steiner suggested that the ideal system would have two batteries and a receiver for each half of the airplane. If one receiver failed, the pilot would still have one elevator and one aileron—enough for a forced landing.

• Use a vertical-whip receiver antenna.

• Don't enclose your receiver and its antenna in carbon fiber. Avoid using carbon fiber or metallic trim aft of the fuselage nose. Carbon fiber is electrically conductive and can cause loss of signal. Try this experiment at your local flying field: find the extreme range of your receiver in a non-carbon-fiber fuselage. Drape three or four layers of carbon-fiber cloth over your radio compartment and check the range. We tried it and reduced the effective range of our receiver by 33 percent! Grounding the negative side of the bat-

UNLIMITED TROPHY WINNERS

Pilot	Race no.	Aircraft	Kit or plans	Wingspan	Length	Weight	Engine	Prop	Fuel
Gold									
1 Don Rice	00	P-51 (Miss America)	Scratch	85.2"	86"	44 lbs.	Aerrow 200S	20x24 (custom)	Gas
2 Don Albright	68	P-51	Sky Aviation	100"	84"	40 lbs.	Eagle (twin)	24x18	Glow
3 Ralph Braun	20	Stiletto	Ziroli plans	80"	84"	36 lbs.	Quadra100	20x16	Gas
Silver									
1 Duke Crow	70	Stiletto	Sky Aviation	78"	84"	42 lbs.	Aerrow 200S	Zinger (mod)	Gas
2 Bryan Keil	84	Stiletto	Ziroli plans	80"	84"	29 lbs.	Husky 5.3	20x16 APC (mod)	Gas
3 Don Kanak	69	P-51	JK Products	100"	84"	39 lbs.	Eagle 8.4	22x22	Glow
Bronze									
1 Kent McKenna	10	Bearcat	Rick Wagner kit	83"	84 7/8"	55 lbs.+	Aerrow 200S	22x18 (mod)	Gas
2 Reno Clark	05	P-51	Bud Nosen kit	102"	84"	34 lbs.	Sachs 4.2	APC	Gas
3 Paul Curly	11	P-51	Nosen (mod)	86"	91"	24 lbs.	Sachs 5.8	20x16 (mod)	Gas
Pilot's Choice									
Mike Helsel	88	Sea Fury	Vailly plans	86.5"	90.4"	54.4 lbs.	Aerrow 200S	24x24	Gas
(Builder- Krohn; this plane was the fastest qualifier)									

Note: AT6/SNJ Racers were restricted to 1/5 scale or larger. Weight minimum was 25 lbs. (dry); weight maximum was 40 lbs. (wet). All AT6/SNJ entries had wingspans of 101". Zenoah G-62 engines we entries were Saxton Glass kits, although Byron kits won all three trophies. Tom Walker's no. 20 won pilot's choice—mainly because his airplane was gorgeous, and deserved it.

tery to the carbon-fiber cloth made most of the problem go away.

The new Robart gear and retract mechanism designed for P-51 wings (right) was developed in tandem with the emergence of the Unlimited races. The 5/8-inch-o.d. strut on the right can handle heavier loads than the older 1/2-inch-o.d. strut on left (the offset was similarly enlarged from 3/8 to 7/16). Factory-recommended installation procedures and drawings tie retract directly to main spar. Parts use 4130 chrome/moly-steel aircraft tube.

STRUCTURAL FAILURE

After covering the '91 Unlimited races, I wanted to find out whether a team of ordinary people from an ordinary flying club could field a competitive aircraft. I looked for these "ordinary" people in my own club (Peninsula Channel Commanders in Half Moon Bay, CA) and set out to gather the materials and an engine.

To select the pilot, we put on a series of Quickie 500 races, limiting the engines to a stock .40 costing less than $70. This method worked well; with one of the smallest engines at Madera (5.3 Husqvarna), Bryan Keil flew our racer to a 2nd-place Silver.

Our team invested more than 2,000 hours in building a racer from a Stiletto kit. The fiberglass fuselage and glass-covered wings and tail feathers required substantial work to assemble and fit together. We learned—from our own experi-

Cliff Adam's home-built 4-stroke O.S. 300 twin landed him a 4th-place Gold slot at Madera '92.

Radio	Servos	Retracts	Spinner
Futaba (PCM)	7	Century Jet	Tru Turn
Futaba (PCM)	8	Robart	Tru Turn
Airtronics (PCM)	Not known	Impact	Tru Turn
Hitec	6	J.M.	Tru Turn
Futaba (FM)	7	Robart	Tru Turn
Futaba (PCM)	11	Barton Machine (mech.)	Tru Turn
JR (PCM)	7	Barton (air)	Tru Turn
Futaba (PCM)	9	Byron	Tru Turn
Futaba (FM)	7	Zinger	Not known
Futaba (FM)	7	Likes Line	Zinger

uired (stock), as were Zinger 22x10 props (supplied). The majority of AT6/SNJ

ENGINE VIBRATION

You've often heard it and read about it: engine vibration; it's the number-one killer of model airplanes! The bigger the engine, the bigger the problem. While it's true that multi-cylinder engines run more smoothly than single-cylinder engines, adding cylinders to a powerplant doesn't automatically result in smooth operation.

I interviewed James George of Monster Motors* about common problems encountered with larger engines and possible solutions to them.

MAN: What causes engine vibration?
JG: Engine run-out (non-concentric revolution of the prop shaft) is the biggest cause of engine vibration in these big engines: unbalanced cranks, hubs that aren't true and prop shafts that are bent. If any one of the three is out of true, the whole ball of wax is garbage. A balanced prop on a bent prop shaft doesn't solve the problem. A crankshaft that's .002 "out" means a prop shaft that's as much as .009 out. Anything more than .002 run-out at the prop hub can result in disaster.

MAN: Do vibration isolators help?
JG: To a certain extent. Isolators won't help much if the run-out hasn't been dealt with. Isolators add problems of their own: shaking at idle and added weight are a couple I can think of.

MAN: The winning aircraft in each class at Madera this year had twin-cylinder engines. Do you think the days of competitive single-cylinder engines are numbered?
JG: I don't think so. People aren't addressing the vibration problem in the proper manner. Install a twin with a bad hub, and you'll shake your airplane apart anyway. It's true that two cylinders balance the load on the crank, and a twin *should* run smoother than a single, but if the *whole engine* isn't true you're going to have the same problems. I think the prospects for a single-cylinder engine to win the gold are better than ever.

MAN: Suppose, in a competition, you have two aircraft that are identical in all but one way: one has a 121cc single cylinder such as the Stihl 084 and the other has a 196cc Aerrow* 200S twin. Shouldn't the twin-powered airplane be faster?
JG: It's a question of balance between the power, weight, prop, dependability, and how clean [aerodynamically] the airplane is. In the Gold trophy race, Stinger Wallace [no. 47; 084 Stihl] was as fast as Don Rice [no. 00; Aerrow 200S]. If Stinger's carb hadn't been set too lean, I believe he may have won. Stinger was running 64 ounces of methanol in 10 minutes, while some Aerrow 200Ss run as much as 100 ounces of gas for the same flight time. That adds weight. The 200S with exhaust is 6 pounds heavier than the 084 with a short pipe. I saw an airplane with 3 pounds of lead in the tail to balance a twin. With a twin, you have twice as much cylinder in the wind, causing drag, and twice as many plugs to worry about. It's a give-and-take situation: it boils down to what a person wants.

MAN: What can an average modeler do to minimize vibration?
JG: Invest in a good dial indicator, and use it regularly. We learned a lot at Madera this year. Billy Hempel had .014 run-out at the prop adapter, and his engine *fell off* in flight! Shim your hub at the faceplate; make sure your prop adapter isn't bent at the shaft. If you really want to balance your engine, send it to me. I'll shave the crank and balance the hub.

MAN: What advice do you have for engine manufacturers?
JG: If the engine is shipped with a hub to buyers, the hub should be turned *on the crank* in a mill. If the crank is more than, say, .006 out, it should be replaced. If it's less than .006 out, it should be shaved before turning the hub. An engine is like a deck of playing cards. To play with a whole deck, everything has to be in there.

ence and from that of others—that in these giant-scale racers, there is no substitute for strength and precise aerodynamic form. I have heard people argue that the fuselages should be light and flexible and that rigidity and structural stiffness are liabilities. I don't believe it. If you're going to build a competitive racer and you plan to install a high-torque engine weighing more than 10 pounds in it, consider the following:

- A 2.5-pound fuselage will require tail weight for balance. An all-composite "oilcan" fuselage only has strength if it doesn't bend. Adding lead to the tail of a racer with a light, flexible fuselage will put stress on it aft of the wing-mounting opening. Pulling a high-G turn around a pylon could cause the fuse to buckle.
- Multi-ply wooden bulkheads and servo trays absorb vibration. Be sure to properly isolate the radio gear from the wood.
- Without a wood structure, an oilcan fuselage will transmit vibration directly to the tail section. Kevlar in the tail section can help absorb vibration.
- A flexible, ultralight fuselage is susceptible to twisting because of engine torque. Flexing and twisting stresses joints in the fuselage. I have seen tail-mounted servos with mounting lugs breaking off when airborne. Flexing also causes slop in pushrod linkages, and that makes the aircraft hard to track.
- A light fuselage is more susceptible to being damaged on hard landings, especially if it has a heavy engine in its nose.
- Rigid wing spars and strong wing skins are absolutely necessary if a racer is to hold together. High-G turns put a tremendous stress on the wings. To prevent the wing from being damaged on hard landings, the gear mounts should be tied into the main spar.
- Before buying an airframe, consult others who already have one from the same manufacturer.

AERROW 200S (Race #00) VS. Stihl 084 (Race #47)


AERROW 200S


Stihl 084

	AERROW 200S	Stihl 084
Source	**Aerrow Inc.***	**Monster Motors***
No. of cylinders	Two, opposed	One
Est. hp	17	15
Displacement	196cc, 11.9 ci	121cc, 7.4 ci
Transfer ports	5	4
Ignition	C&H	Stock magneto
Weight (w/out batt. & exhaust)	11.7lbs	7lbs
Ports modified by	Jim Pileggi	James George
Diameter (ins.)	7.25x13.5x7.5	6.75x9.25x5.5
CNC-machined crankcase	Aluminum	Magnesium
Crankshaft	Hardened steel	Hardened steel
Main bearings	4	2
Prop	Custom 20x24	Bolly 20x20 static
RPM	8,200	8,600
Fuel	Unleaded gas	Methanol

IF YOU'RE PLANNING TO RACE

For more information on the '93 Madera Races, contact "The Unlimited," P.O. Box X, Torrance, CA 90507; (310) 320-8369; fax (310) 320-8354. For updates on other giant-scale racing association races, contact the Giant-Scale Air Racing Association (GSARA), 1744 Greenwood Ave., Torrance, CA 90503; (310) 212-3257; fax (310) 320-8354; or Reno Unlimited Model Air Racing Association, 6801 Flower St., Reno, NV 89502; (702) 677-0869.

Correction: *In Part 1 of this article (February '92), the race numbers 00 and 47 were transposed in the sidebar "Stiletto vs. Mustang."*

**Here are the addresses of the companies mentioned in this article:*
"Monster Motors by George," *417 E. Ironwood, West Monroe, CA 71291.*
Aerrow Inc., *P.O. Box 183, Perth, Ontario, Canada K7H 3E3.*
Adaptive Engineering, *P.O. Box 1691, San Bruno, CA 94066.*

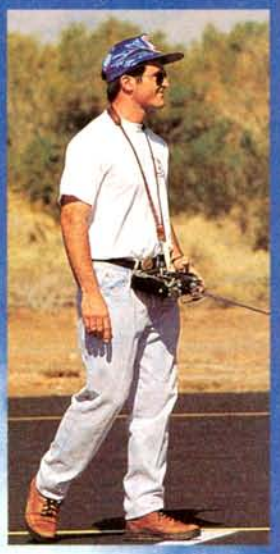
WHAT IT WILL TAKE TO WIN IN '93?

Now that the Unlimited Races are here to stay, competition for the Gold trophy is becoming fierce. If you've been thinking about going for the Gold in September, here are some recommendations that might help you to have a fighting chance:

- Make sure your engine and airframe are capable of sustaining more than 180mph for 10 minutes at a time—on demand—pulling approximately 25 Gs in the turns (build two planes—one for practice, one for racing). The engine must start easily, idle reliably, and be balanced nearly perfectly. It must have a precision-turned spinner and a spare engine (broken-in wouldn't hurt).
- Install an ignition system that will function without producing radio interference at 8,500+rpm.
- Build light, but strong. A total weight, wet, of less than 50 pounds (to allow for repairs) is essential. If you use a lot of carbon fiber in your fuselage, take steps to ensure that it's grounded to the negative terminal of your receiver battery. Allow a few to several thousand person-hours for construction and R&D.
- Install landing gear that can withstand a 100-pound load—with a mounting structure in the wing to match. Spare parts should be plentiful and easy to obtain. Landing gear should have positive lockdown and up. Before you buy, ask whether the supplier will provide technical support at the races.
- Install the best radio you can afford. Spare no expense. Your radio is the only link you have with your investment. It should have flexible mixing options (FM is preferable to PCM). Be prepared to replace servos and batteries at the races.
- Expect to spend $5,000 or more preparing for the races. To that, add the cost of transportation, meals, lodging, fuel, plugs, props and spare parts to arrive at a conservative budget estimate.
- Find a pilot who's cool, calm and steady, able to take direction, used to flying a miniature aircraft in close proximity to others, and who has at least a dozen flights on an aircraft that's similar to or identical to your contest entry.
- Build a team of at least five people (including the pilot) who have practiced together in contest conditions and can stand being around one another constantly for five or six months.
- Make sure your team has the will to win, but that it's balanced by a strong dose of sportsmanship and a well-developed sense of humor.

THE 1992 IN TOURNAMENT

by
TOM ATWOOD



Above: Quique Somenzini shows no signs of tension after a flight. He won 2nd-place Freestyle and 3rd-place overall trophies. Left: Quique's Extra 260.

David von Linsowe's Extra 260 trails smoke in the freestyle event.

PHOTOS BY WALTER SIDAS AND TOM ATWOOD

First-place winner Chip Hyde and his Precision Eagle 4.2-powered, Bob Godfrey-designed balsa/foam Ultimate biplane. Hyde used a Bolly 21x12 prop and a Tru-Turn spinner.

WHAT AVIATION championship—racing or aerobatic, full-scale or R/C—offers the largest purse in the world? The answer may surprise you; it's the Tournament of Champions (TOC). This biannual competition—whether in terms of prize money, the skill levels of the competitors, or the setting—can only be described in superlatives.

The 11th TOC was held from Thursday, October 22, through Sunday, October 25 at the Circus Circus R/C field in Las Vegas, NV. If one person had all eyes on him at this latest aerobatic olympiad, it was Chip Hyde of Henderson, NV. At the 1988 TOC, Hyde,

Steve Stricker's Ultimate on the runway after touchdown.

CD Steve Rojecki completes an Unknown-routine demonstration flight for the judges with his Bucker Jungmann. This ensured the judges would be familiar with the routine before the first contestant flew it.

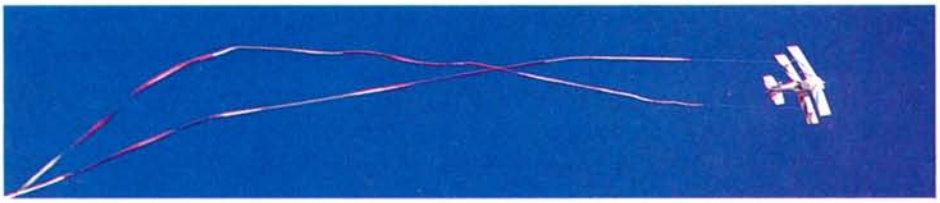
David von Linsowe (left) and his brother John pose with his scratch-built Extra 260 and trophies.

then 16 years old, placed a phenomenal 2nd. At the 1990 event, with his remarkably solid, consistent flying style he out-flew rivals from 10 nations and won 1st place. In 1992——the 11th TOC since 1974—he faced a formidable lineup of seasoned pattern champions. Would he again triumph?

Early in the contest, I asked him whom he viewed as the greatest competition, and as I pursued this, more and more names came up. This is not surprising, given the supreme skill level an aerobatic pilot must achieve before he or she can hope to be invited to this unique event.

Above: Ivan Kristensen checks out his plane in the lineup. Left: Steve Stricker (center) receives his 2nd-place award on the winners' stand from Bill Bennett and Debbie Ellis—Miss TOC. Background: A competitor performs inverted spins during freestyle.

TERNATIONAL OF CHAMPIONS



Ivan Kristensen offered a new twist in freestyle with streamers instead of smoke.

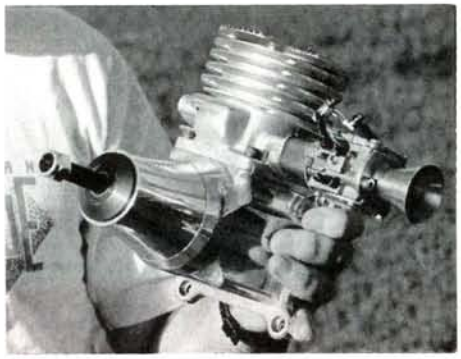
In '92, 11 of the contestants came from the U.S. (seven based on individual combined placement in the 1991 National F3A pattern event and the '91 USA F3A team selection finals, and four at the discretion of contest management). Nine came from abroad (seven based on their '91 World R/C Aerobatic championship placements and two at the discretion of contest management).

Steve Rojecki served as contest director and, as well as ably handling all the duties that position entails, he played a central role in the planning of the Unknown routines (see "Rules" sidebar). Details of these routines were given to the pilots on the evening before they had to fly them; all flew them without the benefit of practice. In 1984, Rojecki was the first U.S. citizen to win the TOC, and he took 5th in '88 and 2nd in '90. His Unknown routines were cited by several contestants as "...very challenging."

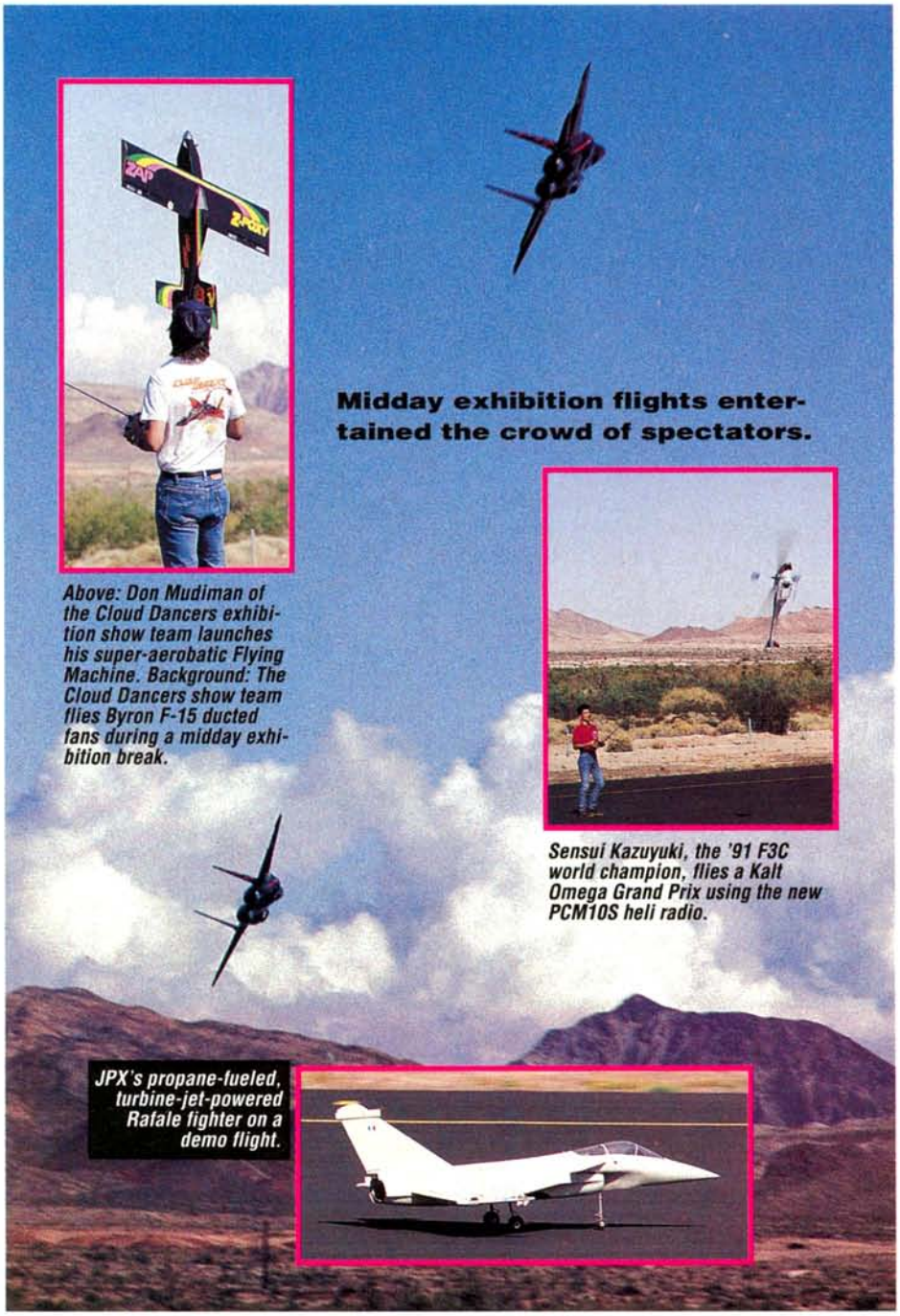
The "aerobatic zone" was defined horizontally by a 75-degree angle on each side of the pilot as he faces 90 degrees to the runway, and vertically by an angle of 60 degrees. All pilots could bring two aircraft—a primary and a backup—but had to stick with the primary unless a failure required a change, and then would have to stick with the backup.

Bill Cunningham practices maneuvers between flights.

Judges for the TOC, as is the tradition, had distinguished credentials. They were selected because of their full-scale or R/C aerobatic competition judging experience. The TOC is intended to duplicate full-scale aerobatic competition to the greatest degree possible. The aerobatic programs selected for the competition bear a close resemblance to the programs flown in full scale competition.



This Webra 4.4 "TOC" engine held by Norm Staub was still too new to be in any of the airplanes.



Above: Don Mudiman of the Cloud Dancers exhibition show team launches his super-aerobatic Flying Machine. Background: The Cloud Dancers show team flies Byron F-15 ducted fans during a midday exhibition break.

Sensui Kazuyuki, the '91 F3C world champion, flies a Kalt Omega Grand Prix using the new PCM10S heli radio.

JPX's propane-fueled, turbine-jet-powered Rafale fighter on a demo flight.

TOC FINAL STANDINGS

Pos.	Pilot	Prize	Plane	Engine
1	Chip Hyde (Henderson, NV)	$ 25,000	Ultimate	Precision Eagle 4.2
2	Steve Stricker (Baltimore, MD)	$15,000	Ultimate	A&M 4.2
3	Quique Somenzini (Argentina)	$10,000	Extra 260	3W Twin
4	David von Linsowe (Mt. Morris, MI)	$7,500	Extra 260	3W Twin
5	Ivan Kristensen (Guelph, Ontario, Canada)	$6,500	Ultimate	3W Twin
6	Bill Cunningham (Tulsa, OK)	$6,000	Extra 300	Sachs 4.2
7	Giichi Naruke (Mobara-Shi, Japan)	$5,500	Extra 300	Sachs 4.2
8	Greg Marsden (Burlington, Ontario, Canada)	$5,000	Extra 300	Precision Eagle 4.2
9	Dean Koger (Xenia, OH)	$4,500	Ultimate	Tartan Twin
10	Hajime Hatta (Tokyo, Japan)	$4,000	Extra 300	Precision Eagle 4.2
11	Geoff Combs (Pickerington, OH)	$3,000	Ultimate	3W Twin
12	Peter Goldsmith (Sydney, Australia)	$3,000	Extra 300	A&M 4.2
13	Dave Patrick (River Forest, IL)	$3,000	Extra 300	Infinity 4.2
14	Mike Klein (Bedford, OH)	$3,000	Ultimate	Precision Eagle 4.2
15	Yoichiro Akiba (Sendai-Shi, Japan)	$3,000	Extra 260	Sachs 4.2
16	Mike McConville (Champaign, IL)	$3,000	S 300	Precision Eagle 4.2
17	Chris Lakin (Springfield, MO)	$3,000	Ultimate	Precision Eagle 4.2
18	Don Weitz (Henderson, NV)	$3,000	Ultimate	A&M 4.2
19	Alexandre DeGotte (Belgium)	$3,000	Ultimate	Sachs 4.2
20	Steve Helms (El Toro, CA)	$3,000	Extra 260	3W Twin

Three-minute freestyle

1	Chip Hyde (Henderson, NV)	$5,000
2	Quique Somenzini (Argentina)	$2,500
3	David von Linsowe (Mt. Morris, MI)	$1,000

THE '92 RULES

- Limited to 20 invited contestants.
- Models must be replicas of full-size aerobatic aircraft; 3-views of the original and model must be provided.
- Outline dimensions (as viewed from the top and side) must be within 10 percent of scale (scale is determined by wingspan).
- General contours and shape must be similar to full-size aircraft's.
- Airfoils are at the pilots' discretion.
- Control-surface hinge positions and hinge type may be different from full-scale plane's.
- Control surfaces *not* on the full-scale aircraft aren't allowed.
- Max. allowable displacement: 4.5ci (75cc).
- Max. weight: ready-to-fly, no fuel—22 pounds.
- Min. wing area: monoplanes—1,100 squares; bipes—1,500.
- Realistic pilot and instrument panel are mandatory.
- Each maneuver earns 1 to 10 points. Scores are composites of total scores multiplied by TOC "K" factors (a difficulty coefficient). No bonus for biplanes this year.
- Qualifying rounds: Known Compulsory Progs. 1 and 2; Unknown Compulsory Progs. 1, 2 and 3; 3-minute freestyle (not compulsory in '90). Top five finalists flew Known Compulsory 1 and 2, Unknown Compulsory 4 and 5 and the free program.

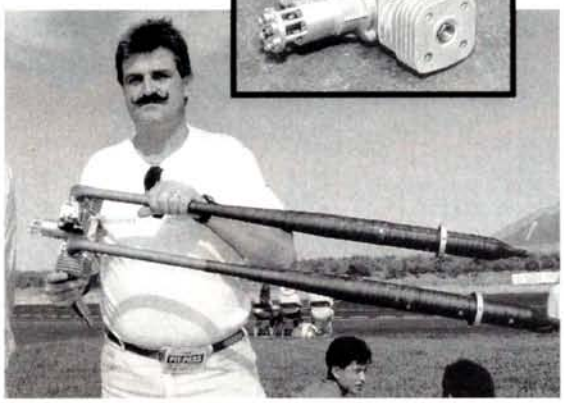
THE COMPETITION UNFOLDS

At the end of the first day of qualifying, which was graced with perfect weather, Hyde, flying a Precision Eagle 4.2-powered, Precision Built Ultimate (Bob Godfrey design) was in 1st place. Steve Stricker, flying an A&M 4.2-powered Ultimate of his own design was in 2nd place. (His strong position was no surprise; he took 4th at the TOC in '90 and 2nd in '84.)

In 3rd position was Quique Somenzini of Argentina, flying a 3W-powered Extra 260. Somenzini really charmed the thousands of spectators at the 1990 TOC, particularly with his powerful, balletic freestyle. Nine-times and current South American champion, he placed 7th overall in 1990, and many felt he had a real chance to surge forward at this TOC—perhaps to the top.

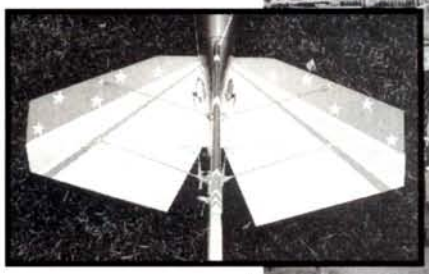
In 4th position was current U.S. national pattern champion David von Linsowe. David,

(Continued on page 85)

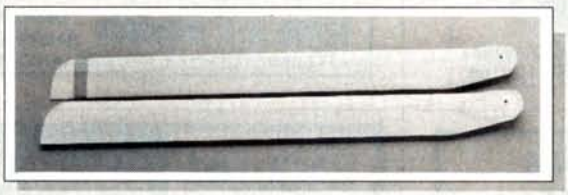


Sue Patrick and "Aerobatics Made Easy" columnist Dave Patrick, who placed a respectable 13th in this—his first—TOC, pose behind Dave's Extra 300. Sue pilots 737s; as you might expect, they met at an airport!

Above: several competitors flew this new 3W 70cc (4.2ci) opposed twin engine from 3W Modellmotoren of Germany (here held by Peter Weinhold of 3W). Steve Helm's Extra 260 used this engine with a 20x14 3-blade prop, and it appeared to be the fastest and quietest plane in the competition. Right: after the rain, Steve Stricker carries his scratch-built Ultimate fuselage to his pit area. Below: note the doubled servos that control rudder on Stricker's Ultimate.



NEW HELI PRODUCTS



GREAT PLANES Heli-Max SR Main Rotor Blades

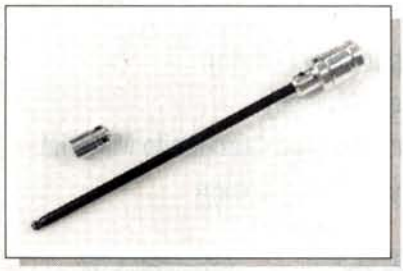
These blades were designed specifically for the Concept 30 SR. They are of conventional wood construction, and they are slotted for lead weights. Less expensive than the original Kyosho SR blades, these blades are, on the average, slightly heavier (although the lead weight has been moved inward to help preserve steering response). Root reinforcements are installed. The ends of the heat-shrink tubing have been melted together to conform to the tip of the blade.

Part no. HMXE4300
Price: $42.95

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826; (217) 398-6300.

KSJ Hex Start System

This system for the Baron Alpha II is designed to make engine starting easier and more efficient. Simply bolt this part onto the engine shaft, and you're ready for takeoff. The unique hex-shaped, ball-type end of the probe allows more angular freedom for starting.



Because it only requires a small hole, this system is also helpful for all fuselage fliers. It's supported by a top-grade NMB bearing and made of machined aluminum and steel.

Part no. KSJ136
Price: $66.95

KSJ; distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-0022.

Z ENTERPRISE Tool Kit

Use Z Enterprise's new, two-piece tool kit to install and remove the Concept 30 clutch easily. The hex-collet-type tool grips the 1/4-28 threaded end of the crankshaft firmly and allows the spanner wrench to apply all the necessary force. No force is applied to the crankcase, the crankpin, the connecting rod, or the piston.

Price: $19.95 (plus $3 S&H)

Z Enterprise, 4155 Eastlake Rd., Muskegon, MI 49444; (616) 733-4645.

MINIATURE AIRCRAFT USA Side-Mount Fan-Shroud Kit and Optional Gear Ratio Adapter Kit

The new fan shroud is of the same basic design as the original no. 0253 except that the two front mounting screws have been eliminated. This shroud is mounted with two side-mount aluminum brackets connected to side motor-mounting bolts. All the necessary hardware is included.

Part no. 0548
Price: $29.95

The three optional main-gear ratios were developed for precision FAI competition flying. These ratios, coupled with engine and main-blade designs, will provide maximum performance for any rpm setup. Main gears are sold separately from the adapter kits.

Part no. 0549
Price: $54.95

Miniature Aircraft USA, 2324 N. Orange Blossom Trail, Orlando, FL 32804; (407) 422-1531.

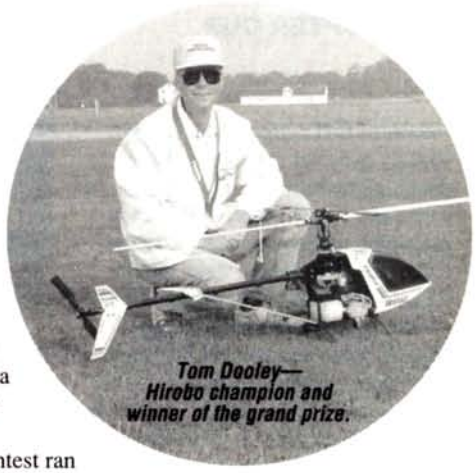
by TIM DIPERI

Helicopter Cup

HIROBO

THE PLACE—Colts Neck, NJ. The event—the First Annual Hirobo Cup. The prize—an all-expense-paid trip to Japan!

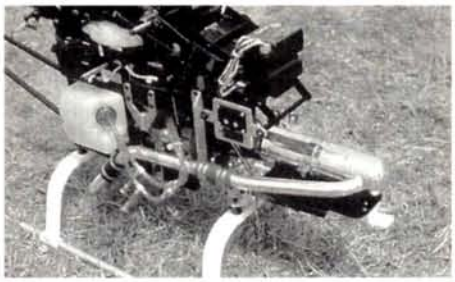
Based in Japan, Hirobo is the world's largest manufacturer of R/C helicopters. In October '92, Altech Marketing (the U.S. importer of Hirobo products) and Hirobo Ltd. organized and funded one of the largest helicopter events in America. In Japan, there are many Hirobo Cups in different regions of the country. Traditionally, there is only one class (FAI) of competition. At the first U.S. Hirobo Cup, the event organizers offered a helicopter clinic as well as the FAI competition.



Tom Dooley—Hirobo champion and winner of the grand prize.

HELI DOCTORS

During the clinic, which started on a Saturday morning, Hirobo team members helped to set up helicopters and diagnose and repair their problems regardless of the machine's manufacturer. The U.S. Hirobo team consisted of long-time helicopter veteran Mike Mas, Tom Dooley, "Nob" Muraki, Stan Olzaski and me. We each manned a table and worked on helicopters. Within 20 minutes, there was a line of people waiting to get help. Since there were a lot of helicopters waiting to be worked on, we convinced a couple of members of the Helicopter Enthusiasts of Long Island to help trim out some of the helis. (Thanks, Ken and Kevin!) We worked as if we were on an assembly line, and no one was unhappy with the results. The clinic was a tremendous success. Even experienced modelers wanted expert opinions just to "feel out" their helicopters.



Internal view of Robert Gorham's TSK.

THE EVENT

By the afternoon of the first day, the competition had begun. Current FAI rules applied, and the highest-place Hirobo flier (using a Hirobo helicopter) for this event, would win a trip to Japan where he would compete in a large international contest.

Although the contest ran smoothly, the first round brought bad luck to some. Wayne Mann (1992 National Champion), Dwight Schilling ('92 Nationals, 3rd place) and I had trouble getting our engines to shut off in time for the 180-degree autorotation. We were each given a zero from all five judges. Also, Ted Schoonard had to land prematurely because of a broken tail fin. By the end of the first day, Robert Gorham and his TSK helicopter were in 1st place, and Mike Mas was in the number-one spot for Team Hirobo.

During the second day, there were two

Dwight Schilling in the ready box.

The winners (left to right): Wayne Mann, Robert Gorham, Dwight Schilling, Ted Schoonard and Tom Dooley.

rounds of FAI competition. It was slightly overcast and a little cooler than the previous day. I got there early, and competitors were already practicing in the ground fog. By the end of the day, the top three pilots were within only a few points of one another; between Robert Gorham, Wayne Mann and Dwight Schilling, it could have been anyone's contest. Schilling's last flight ended with a slightly short autorotation, and that cost him valuable points. In the end, Wayne Mann was in 1st place, Robert Gorham in 2nd and Dwight Schilling in 3rd.

THE WINNER

The trip to Japan went to the newest member of the Hirobo team, Tom Dooley. (Dooley flew on the U.S. team at the '89 world championships, and he went on to win 1st place at the Hirobo Cup grand final in Japan.) Altech Marketing gave away several helicopters, a radio system and tons of other small prizes in a raffle. It was interesting to see the equipment that other people use. There are many good helicopters, and virtually all of them were represented at this contest.

THE EQUIPMENT

Some very sophisticated R/C equipment today is geared toward helicopter fliers. Most modelers at this event preferred Futaba radios.

Reliable engines are critical to a helicopter's success. The preferred three were Enya, O.S. and Y.S. The highly popular Enya .35 helicopter engine dominated in numbers. Schilling showed me the new O.S. engine that has not yet been released. It looks good, and it uses an entirely new carburetor that has three needle valves similar to those on the Y.S., and a raised exhaust port.

Rotor blades are another magical ingredient of helicopter flying. Two blades were equally popular: the Zig Saw GP-9 blades and the new, light blue F1-50. Both are fiberglass and are imported by Sabin Models.

Morgan fuel (Cool Power) was the choice of these heli fliers. With its special 30-percent helicopter blend, it allows super-smooth hovering with maximum power at top end. The high oil and nitro content allows maximum engine cooling. Almost all of the competitors used an in-flight needle-valve adjustment.

WINNERS

Pilot	Total	Model
Wayne Mann	427.0	X-Cell
Robert Gorham	420.5	TSK
Dwight Schilling	418.0	Concept .60
Ted Schoonard	403.5	X-Cell
Tom Dooley*	401.5	Hirobo
Mike Mas	383.0	Hirobo
Stanley Olzaski	379.5	Hirobo
Ray St. Onge	373.5	Schluter
Yasunobu Muraki	364.0	Hirobo
R. Belluomini	320.0	Schluter
Tim Diperi	310.5	Hirobo
Len Sabato	307.0	Kalt
Arne Ernits	266.5	X-Cell
Santos Font	143.5	TSK
Brian Walker	136.0	Hirobo

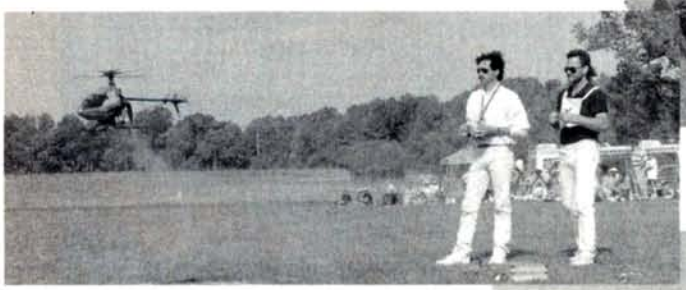
* As the Hirobo flier with the highest score, Tom Dooley won the trip to Japan.

THE JUDGES

I want to comment about the judges. Like most competitors, I'm not concerned about actual scores so much as consistency. Tom Unger, Jeff Baker, Tom McAteer, John D'Arcangelo and Barry Wehrung were among the finest judges I have ever dealt with. These men also judged the '92 Nationals and the Gauntlet (an international contest in New York).

Altech Marketing manager Gabe Mastriano, CD Horace Hagan and chief judge Tom Unger organized this well-run operation. This was the first event at which it was impossible to *buy* anything. Food was free. Even the shirts and hats were free! At the clinic, there was a box of Hirobo Shuttle parts in case anyone needed them. You just couldn't buy anything! It's unusual for a distributor to be so generous. If you fly helicopters, are thinking of flying them, or just want to have a good time, you shouldn't miss this event in '93!

Right to left: Dwight Schilling, Makoto Kunii and Stan Olzaski watch the competition.



Ted Schoonard in the warm-up box as Wayne Mann calls.

Bob Belluomini in the "ready" box with a Schluter Futura. Ray St. Onge is the caller.

SIMPLE PROGRAMMING

DAVID C. BARON

A NEW STANDARD IN EASE OF USE

EVERY ONCE IN a while, something important comes along that's truly exciting. The Airtronics* Infinity 660 radio is in that class. Possibly, it's the best thing since pull/pull linkages. Seriously, it's a major breakthrough because the programming is so simple that you never have to worry about having the manual by your side.

The program in this radio doesn't have any resemblance to the ATRCS program in the Airtronics 600. It might not be as flexible as the 600's system, but it's much friendlier to the user, and it includes some important items that aren't available in the ATRCS program, such as exponential and clock functions.

The new Airtronics 660 advanced microcomputer R/C system is very easy to program.

USER FRIENDLY

The use of plain language in the display and the amount of information that is displayed makes this radio very simple to use. If you have been waiting to buy a computer radio but have felt intimidated by all the confusing function codes and monster manuals, check out the 660. After you've read the manual and experimented with manipulating the control surfaces of a flying machine, you feel as if you have been using this radio for years. In very short order, you should be comfortable enough to go straight to the field and make modifications to the program without consulting the manual.

Its best feature is that you view multiple functions in the display simultaneously. The Helicopter, Aeroplane and Glider modes all have seven "pages" of display (see Figure 1). The first display in all cases is the "initial" screen. The first item shown is the mode (AERO, HELI, or GLID). The second item in the display is the time-elapsed clock, which is most often used to show how long it has been since the radio was last charged. (It only works this way if you remember to reset it after charging.) The next item in the display is another clock that can be configured as a countdown timer to an alarm or a count-up timer, à la a stopwatch. For those of you who buy timers and have them "Velcroed"® to the front of your transmitters or clipped to the antennas, your radio has arrived. The lower left corner of the initial screen contains the name of your plane or heli—up to 10 characters. The last item in the display is the digital voltmeter. It monitors your transmitter voltage all the time the radio is on and will trigger an alarm when the voltage falls below 9.1 volts. Obviously, it's time to land (quickly) when this occurs.

KEYPAD

The keypad comprises six keys, and each is clearly labeled (see Figure 2). The upper right is the edit key. Strike this key to advance through the seven pages of functions. The cursor left (<) and the cursor right (>) keys are used to select the functions. Press the appropriate key to move the flashing cursor to the function you need. When you arrive at the function that you wish to modify or change, press the "YES/INC+" key to activate the function. The function you have activated will be identified in the upper left corner of the display. You may be required to

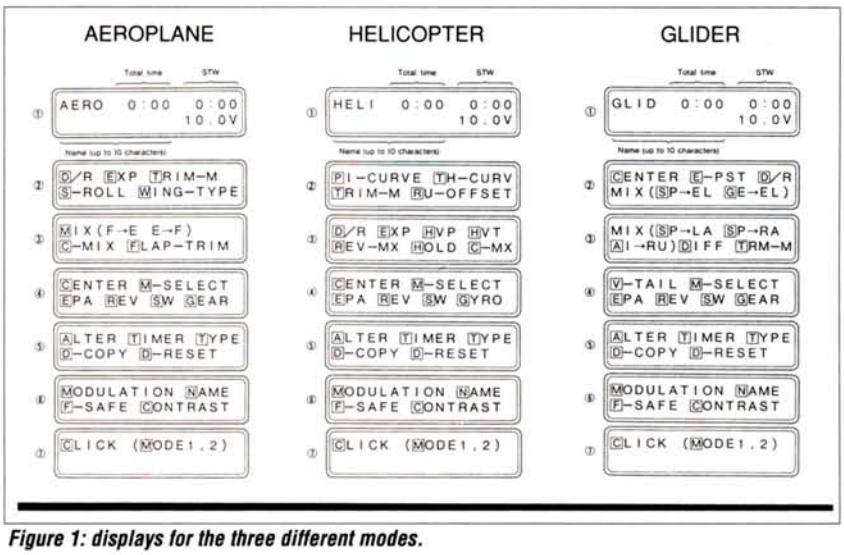


Figure 1: displays for the three different modes.

use the cursor keys to get to the channel or setting within the function that needs adjustment. Once at that channel, then either the "YES/INC+" or "NO/DEC-" keys will establish the direction (positive or negative) or quantity of mix or throw that you wish to use. Finally, the END key will deliver you back to the page of the display where you first selected the function you just used.

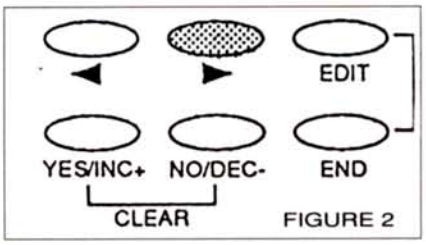
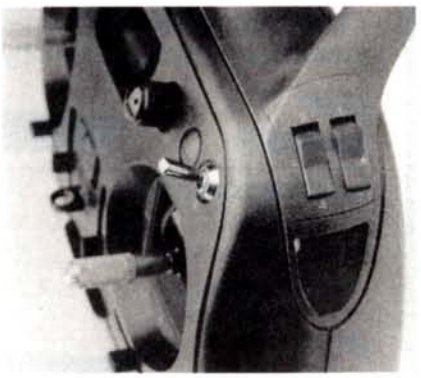


FIGURE 2

Note: pressing the "YES/INC+" and "NO/DEC-" keys simultaneously will clear any function back to the default setting. Also, it's the quickest way back to "0" if you find you're going in the wrong direction.

Pressing the EDIT and END keys simultaneously will allow you to go backward through the seven pages of displays.

The battery case, located at bottom rear, slides out as a unit—complete with charge jack. The trainer port is at the lower left.



Each rocker switch has two numbers assigned to it. Any switch number can be assigned to any function that utilizes switches.

SPECIFICATIONS

Manufacturer: Airtronics
Model: Infinity 660
Prices: $679.95 (FM model); $729.95 (PCM model).
No. of channels: 6
No. of model memories: 4
Tx duration from full charge: 3 hours, 15 minutes

Notable and new: this radio sets new standards for ease of primary programming. It features custom switch position settings and an "alternate mode." Nice, solid feel and novel look of radio.

Hits
- Ease of primary programming
- Easy program modification
- Switch assignment flexibility

Glider program
- Hit: elevator re-trim for many different functions and preset elevator trim positions
- Miss: no "C MIX" (compensation mixes)

Aeroplane program
- Hit: very complete
- Miss: lacks spoiler function (only relevant to some scale and fun-fly aircraft)

Helicopter program
- Hit: rudder offset for all three flight modes

HINTS

Have your plane's radio on at all times while experimenting and move the "sticks" to visually confirm the changes that you make (while you are making them). This is especially critical where travel direction is concerned. Watch things happen and see how the control surfaces interact. Everything will make sense sooner this way!

CASE

To be honest, it sort of reminds me of the tail end of a Ford Taurus wagon and it feels great in your hands. If it doesn't feel entirely natural when you hold it, make sure that the antenna is extended all the way. It's definitely out of balance with the antenna collapsed.

EXCEPTIONAL FEATURES

• **Switches.** As in the 600, any of the functions, dual rates or options can be assigned to any switch and switch position. This even includes the clock functions. I set mine up to activate the stopwatch by toggling the spring-loaded switch on the upper left of the case. This is really handy if you need to time maneuvers or laps.

The LCD display panel and keyboard are behind the front access hatch. Display contrast can be adjusted electronically.

• **Alternate.** This function allows you to switch between any two of the four model memories by simply flipping a switch on the face of the transmitter. This concept is so new that I believe we have only skimmed the surface of potential applications for it. For example, you're

(Continued on page 116)

FAN FLY

(Continued from page 42)

with about a dozen parts that you assemble and cover; install your equipment and go fly! What's the tariff for this welcome package? Right around the $225 mark! Line forms behind me, folks!

One can only wonder what the 20th anniversary of the SWFF will bring. Routine use of real turbojet engines? Perhaps. Exhaust systems that make the jets sound more realistic? Maybe, but electrics might be the answer to that one. Lynn McCauley building an 1/8-scale model of the Aurora project? Possibly. A 19-year-old Daniel Ligon flying a 20-year-old Byron MiG? Nah!

As the song goes, see you in September....

OSPREY

(Continued from page 49)

forget that when you do this, you need three blades for clockwise and three for counterclockwise. On the first Osprey's rotors, I used silver MonoKote for covering, and it looked good. On the second set, I used one coat of O.D. Pactra. The benefit of using paint is that it lets me make repairs with Zap a Gap* at the flying field.

The hub is cut from a sheet of aluminum. When bolting the blades to the hubs, use a little Loctite* to keep them from working loose. The spinners aren't necessary for anything but scale effect. I made them by putting a Carl Goldberg* "snap on spinner" on my drill, and spinning it to flatten its tip and drill a hole into it. Then, I spun it against a saw blade to cut off its base.

Set the pitch and dihedral in the rotors by using the tool shown on the plans. With the rotor mounted in the tool, use a wrench to bend and twist the hub at the root of each blade. Setting the pitch is very important to a smooth, straight flight. If one rotor has more or less pitch than the others, the Osprey will vibrate or crab sideways. It's a good idea to include the rotor alignment tool in your flight box. Balance the rotors by clamping the rotor tool on its side so the rotor can spin freely. A 1-inch strip of MonoKote trim works great for balancing. Start with one wrap on each blade and just keep adding it until the blade is balanced. Remember, one rotor will spin clockwise, and one counterclockwise.

TIPS FOR FINISHING

When all the parts were epoxied together, I finished covering the wing center section and hooking up the control surfaces. I finally figured out what to do with that funny little piece of black tubing that comes with control rods. I cut it into four pieces—two long and two short—and put it between the firewall and the engine mount. This allows me to adjust the angle on the engine by tightening the bolts that hold it on. It also helps to dampen vibration from the engine. The side blisters are taped on with MonoKote trim. I attached the nose and canopy with the small screws that line up with the ply areas of the fuselage.

TIPS FOR FLYING

The Osprey is easy to fly. Just remember that the elevator controls the angle of attack. This will affect altitude, but not nearly as much as the throttle will. It's very important to have the Osprey headed directly into the wind. If it's not, the upwind rotor will begin to lift first (bad news). That's one of the reasons for the swiveling nose gear. One other thing that helps with this problem is to cut back on the throttle for just a few seconds after the Osprey begins to roll out. This keeps it on the ground for the full 50 feet and allows the rotors to come up to speed together. Once in the air, the Osprey is slow and very easy to fly, and landing is even simpler—just cut the throttle. I think this is one aircraft you can have a lot of fun with.

**Here are the addresses of the companies mentioned in this article:*
Cox Hobbies, *350 W. Rincon St., Corona, CA 91720.*
Pactra Inc., *620 Buckbee St., Rockford, IL 61104.*
Zap; *distributed by FTE, 15300 Estancia Ln., W. Palm Beach, FL 33414.*
Loctite Corp., *4450 Cranwood Ct., Cleveland, OH 44128.*
Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*
K&S Engineering, *6917 W. 59th St., Chicago, IL 60638.*

CHAMPIONS

(Continued from page 73)

who also won 3rd place in the '91 world championships, and who placed 13th at the last TOC, was flying a 3W twin-powered Extra 260 of his own design. Bill Cunningham, flying a Sachs 4.2-powered Extra-300 (Godfrey design), was in 5th place. He took 2nd in the '92 Nationals and 5th overall at the last TOC.

In 6th, 7th and 8th places were Greg Marsden, of Canada (flying a Precision Eagle-powered Extra 300 now imported by M.A.T.), Ivan Kristensen, also of Canada (flying a 3W-powered Godfrey Ultimate) and Giichi Naruke of Japan (flying a Sachs-Dolmar-powered Extra 300). Marsden was 1st in the '92 Canadian Nationals and a member of the 1st-place World Championship Team. He finished 8th in the '92 U.S. Nats. Kristensen, five times a TOC trophy winner, also has been seven times Canadian and

(Continued on page 94)

CENTER ON LIFT

MICHAEL LACHOWSKI

FINISHING OBECHI

THIS MONTH, as a follow-up to my article on sheeting wings with obechi, I'll describe a lightweight finishing technique. For those of you who prefer to build kits, there is a mini review on the NSP Sparrow slope soarer, and finally, I'll tell you how you can add some variety to your usual 7-minute, crash-on-the-spot contests.

FOAM-FRIENDLY WOOD FINISHES

To seal and protect wood that has been laminated over foam wings, you must finish it. The lightest finish you can apply is a clear coat. You want a paint that will not eat the foam, if paint solvent seeps through the wood.

One solution is to use water-based polyurethane as the clear coat. This is somewhat new on the market and is environmentally friendly, since the usual solvents are not present. Two of the brands I have tried are Varathane Diamond Finish Transparent IPN Coating by Flecto and Polycrylic by Minwax. Other fliers have also had success with Carver Tripp paint (any of these paints can be found at your local hardware store). Opening the can, you find a milky white liquid. Don't worry, when it's dry, you get a clear finish. These paints can be cleaned up with water and have very little odor. The only negative point is that they lack UV protection. I guess they still haven't figured out how to put UV protection in with water-based solvents.

You can use foam brushes, paper towels, or an old T-shirt to apply the finish to the model. Don't shake the can. Stir it to avoid creating air bubbles. You don't want air bubbles in the finish, so stir carefully. Also, avoid brushes that are designed for latex paints. Let the first coat dry, and sand lightly between coats to get a smooth finish. Don't put on a heavy coat; use several light ones.

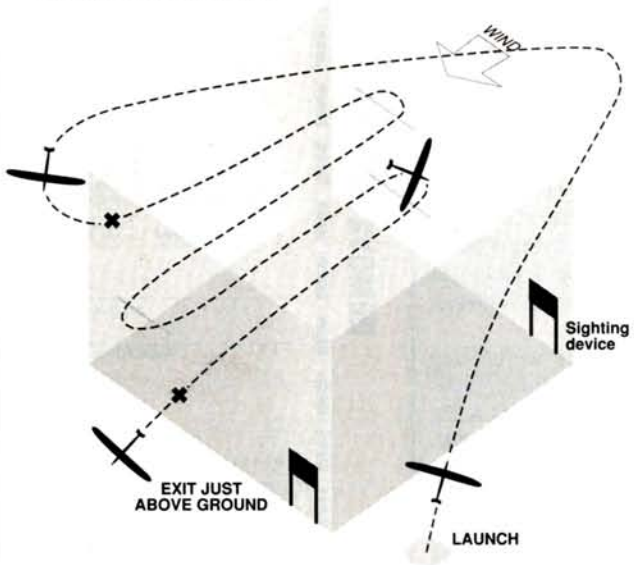
SOME NOTES ON OBECHI

You can apply water-based polyurethane to obechi to prevent epoxy from bleeding through the surface when you sheet the wing. Wipe a thin coat onto the inner surface of the sheeting before it is applied to the wing. This also makes the obechi a little less prone to splitting before you get it on the wing. The weight added is minimal, and less epoxy will soak into the wood.

To get a smooth surface on the obechi, use Red Devil One-Time Spackling (available at hardware stores) or Carl Goldberg* Model Magic filler. Spread the filler over the wing, let it dry for a few minutes, and scrape at an angle of 45 degrees to the grain to remove any excess. After the filler has dried, sand the wing to remove any excess. You can repeat this if you want to be sure that you have really filled all the grain. Now you can proceed with the water-based polyurethane finish.

The filler will leave white lines on the

PUT SOME ZIP IN YOUR CONTESTS

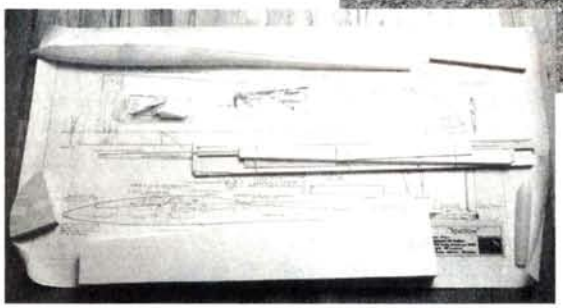


The 150-meter course for speed (Task T8).

At the next club contest, dig out your AMA rulebook and try Task T8. Yes, it is "speed." I visited the Southern New Hampshire Flying Eagles glider contest in October, and they tried a speed task. Only half of the fliers participated, but everyone had a good time. What is a speed task? The objective is to fly two laps on a 150-meter course (four laps, in FAI jargon). The course is measured by two sighting devices that set up parallel planes 150 meters apart. The flier launches and flies back to base A, which is the start/finish line. Timing is started when the plane crosses the vertical plane at base A, flying toward base B. The pilot flies to base B (lap 1), turns, returns to base A (lap 2), turns, returns to base B (lap 3), turns, and exits the course at base A (lap 4).

Dennis Phelan provided the launching equipment and sighting devices for CD Alton Ryder. I gave the first demonstration run on the course. Then the fun began for everyone else. Fliers tried various ships, including a Ninja, a Mariah, a Falcon and assorted other 2 meter and Unlimited ships. We only flew one round for the contest, but everyone kept flying afterward. We finally stopped when the CD wanted to award prizes and wrap up the contest. It may sound easy, just flying back and forth on the course, but if you aren't used to flying on a course, putting the glider where you want it can be a real challenge. You would be amazed at how long big, wide turns can take. Some of the best times were from fliers who just concentrated on staying on the course and didn't try to fly fast. Many of the fliers learned a lot about controlling their sailplanes.

wood. You can tint the filler to match the wood if you don't like the white (or use Carl Goldberg's new tan-color Model Magic). If you use a coloring material, make sure that it is compatible with water-based paints. Now follow up with several coats of polyurethane, wet-sand and rub out the finish with Meguiar's Mirror Glaze (available at most auto-supply stores). If you don't put on a million coats, this finish comes in at 0.3 to 0.5 ounce per square foot of wing area (actually 2 square feet of surface area). The 0.3-ounce figure gives you 1.25 ounces for a 600-square-inch wing.



Above: the Northeast Sailplanes Sparrow has an SD 7080 airfoil, a fiberglass fuselage and foam-core wings. A nice sloper, it has a good roll rate and flies well inverted. Left: Sparrow kit parts.

There are other approaches to clear finishes, and I'll cover them in some future columns. If you get your obechi from Dave's Wood Products*, with your order, he includes plenty of other tips on working with and finishing obechi.

NORTHEAST SAILPLANE SPARROW

A few weeks before a recent trip to Cape Cod, I called Sal at Northeast Sailplanes* to find an interesting slope soarer I could build. Sal recommended the Sparrow kit—a 65-inch slope ship with an SD 7080 airfoil and a vee-tail. When the kit arrived, I found a fiberglass fuselage, nicely cut foam-cores, complete hardware, and decent wood. Construction is very quick. I completed the model in six evenings.

I made a few modifications along the way, including a few balsa replacements and some carbon-fiber tow in the wing, and I mounted two aileron servos in the wing in place of the strip aileron linkages. The Futaba 5102s are a little thicker than the wing and extend 3/32-inch below it. With the two servos, I configured the controls on my Airtronics* Vision for flaperons.

The fuselage is small, so don't expect full-size equipment to fit. I use a 200mA AAA square battery pack from Cermark*, an RCD* 5-channel receiver and a 5102 servo for the elevator. I added a ballast mount under the wing and made up a few weights to get ready for stronger lift.

For a finish, I tried out the new Coverite* 21st Century film in neon red and green. I had no problems putting the Coverite over sheeting. Coverite is a polyester film that can be applied at a low temperature and shrinks at a much higher temperature. Shrinking this material is interesting, since it shrinks slowly. This helps to shrink the covering evenly over the wing. I left the fuse in natural fiberglass to save weight and time. The finished weight is 23 ounces, and I have flown it with up to 8 ounces of ballast.

The Sparrow flew well from the start. It will stay up in light lift like an HLG, and it can move out in stronger lift with added ballast. The SD 7080 airfoil is similar to the well-known S 3021, but it is thinner and has less camber. With this airfoil, the Sparrow can fly in light lift, but it still has good high-speed performance. The extra weight extends the speed range for stronger winds. I have also flown the Sparrow on inland slopes successfully. Sal says these are the conditions for which the Sparrow was designed. The Sparrow thermals well if your slope lift is light.

The addition of flaperons provides extra control over the speed range. Dropping the flaps is handy for slowing things down and for hanging around in the sky, and they help on landings. You do have to remember to pull the flaps up when you want more aileron response. The aileron and elevator controls are good for aerobatics. It has a good roll rate and flies well inverted, too.

After flying my Sparrow and seeing a few others that had some flight time on them, there is one other change I would make. The fuselage could use a little reinforcement around the wing bolt blocks to prevent cracks from starting in the wing-mounting area. The wing-mount bolts should also be reduced from the ¼-20 supplied in the kit to something in the 10-32 range. The smaller bolt will shear in the event of a rough landing, or if your Sparrow hits a tree or other obstruction. If you're looking for an enjoyable little slope ship, try out the Sparrow. A nice design, and reasonably priced at $99.95.

That's all for this month. I hope you find some of the tips and techniques in this column useful. If you have any good ideas for building or flying (or have stolen some good ideas), drop me a note and I'll share them with your fellow readers.

**Here are the addresses of the companies mentioned in this article:*

***Carl Goldberg Models**, 4734 W. Chicago Ave., Chicago, IL 60651.*

***Dave's Wood Products**, 12306 Bergstrasse, Leavenworth, WA 98826; (509) 548-5201.*

***Northeast Sailplane Products**, 16 Kirby Ln., Williston, VT 05495; (802) 658-9482.*

***Airtronics**, 11 Autry, Irvine, CA 92718; (714) 830-8769.*

***Cermark**, 107 Edward Ave., Fullerton, CA 92633; (714) 680-5888.*

***RCD**, 9419 Abraham Way, Santee, CA 92071; (609) 449-1112.*

***Coverite**, 420 Babylon Rd., Horsham, PA 19044.*

MODEL AIRPLANE NEWS
FIELD & BENCH REVIEW

PHOTOS BY JOHN LUPPERGER

GRAUPNER

SOLAR UHU

The next step

by JOHN LUPPERGER

DISTRIBUTED BY Hobby Lobby International*, the Graupner Solar UHU is an electric glider that carries 20 solar cells on its wing. These constantly charge the electric flight-system battery. The solar cells produce a constant-charge current of 10 volts at approximately 1 amp (this is optimal output in direct sunlight).

Depending on the type of cells used, charging time will be somewhere between two and four hours, or more. On a bright, sunny day with decent thermals, the Solar UHU could be airborne for hours and always have reserve climbing power.

The Solar UHU can be built in one of three configurations: as a straight glider, as an electric glider, or as a solar-charge-assisted electric glider. A 1700mAh flight battery will give you run times of around 5 or 6 minutes. This, combined with in-flight recharging, will allow you to climb to thermal altitude—say, 400 to 450 feet—three to four times.

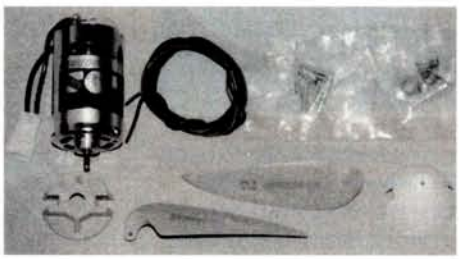
THE KIT

The kit's components were well-packed and arrived in good condition. All the parts and the wood were carefully bagged and stacked and/or held with rubber bands. The wood is of excellent quality, and the density of specific pieces is well-matched to its particular function. The die-cutting was above average, and all the parts were easy to extricate from the die-cut sheets.

The kit includes an excellent hardware package. The solar cells are neatly stacked with thin sheets of foam between them and then packaged in a sturdy foam box. All the hookup wire and connectors are provided.

Like many of Graupner's kits, the Solar UHU comes with a formed Perfekt plastic fuselage and canopy. The material appears to be ABS plastic, and it's very strong, but only slightly heavier than fiberglass.

Although annotated in German, the plans are clear and easy to understand. The English instructions are on eight sheets that include a list of parts. Another large sheet shows an exploded view of the model's construction (very helpful), and there's also a sheet that diagrams the solar charge system and the flight system. All in all, it's a very comprehensive building guide.



The Graupner Solar Speed 600 drive system.

Although not part of the kit, the Solar Speed 600 drive system (motor, prop, spinner, connecting wire, connectors, capacitor, etc.) was designed for the Solar UHU and creates a total package.

SPECIFICATIONS

Type: Electric glider
Wingspan: 71 inches
Wing area: 465 square inches
Length: 32 inches.
Weight with battery: 44 ounces (as built, 46 ounces)
Wing loading: 13.6 ounces/square foot (as built, 14.2 ounces)
Motor: Graupner 7.2V Solar Speed 600 drive system
Motor control: Graupner JR Power Switch 20 with BEC
Battery: 7.2V, 1700mAh
Prop: 8x4.5 Graupner Scimitar folding prop
No. of channels req'd: 3 (rudder, elevator, motor control)
Radio used: Cirrus 5 PCM with two CS-133 servos
Sug. price: $99 (plane only); $225 (with solar cells); GR1295 motor/prop Solar Speed 600 drive system—$52.80

To ensure maximum exposure of the solar cells to sunlight, the Solar UHU wing has very little dihedral.

Features: the kit includes a Perfekt formed-plastic fuselage, all the necessary hardware and wood, solar cells carefully packed in a foam container and all wire and connectors. The Solar Speed 600 drive system is sold separately.

Hits
- The parts show high-quality German craftsmanship; excellent wood selection.
- Pre-formed fuselage saves building time.
- Exploded view in plans facilitates construction.
- Solar-cell technology in a production kit.

Misses
- The recommended drive system is designed to draw less current, and compared with many electrics being flown today, it's slightly low on power.

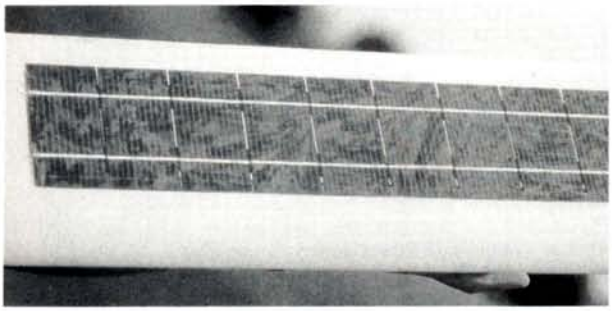
CONSTRUCTION

Construction starts with the fuselage. The air inlets, the area for the motor shaft, the rudder-pushrod exit and the rear of the fuselage are opened with an X-Acto knife and shaped with a file. The plywood firewall is then glued inside the front of the fuselage.

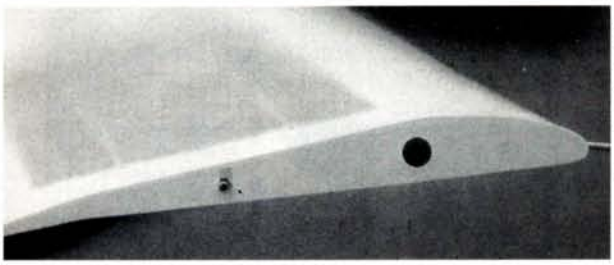
To hold the servos and receiver, a plywood crutch is assembled at the rear of the wing opening. The servos are mounted on the plywood, and this assembly—along with a plywood tray for the flight battery—is glued into the fuselage. The Bowden linkage cables for the elevator and rudder are then glued inside the fuselage with epoxy. A small piece of reinforcing plywood is glued inside the fuselage at the front of the wing saddle, and a plywood web with T-nuts is glued into the wing opening for wing attachment.

The vertical stab and rudder are die-cut sheet balsa and require only a slight sanding and shaping. The horizontal stab consists of one sheet with two small tips (cross-grain to stab) and a "locating dowel."

The wing is built pretty much like most conventional D-tube glid-



In the kit, the delicate solar cells are carefully packaged. The long solder tabs come tinned, and that makes assembling the panels relatively easy. Under optimal conditions, the panels generate about 10 watts of charging power.



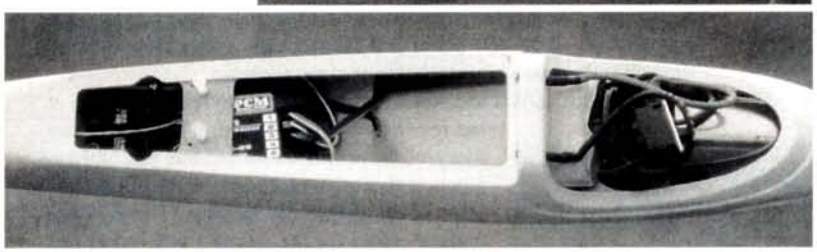
In this photo, you can see the power connectors at the leading edge of the wing and at the secondary wing joiner. The unusual airfoil is also shown.

er wings. A piece of angled balsa block must be glued to the side of your building board, flush with the edge and top surface. The rather unusual-looking airfoil has an angled droop at its trailing edge. The angled balsa allows you to build the wing flat on the building board with the drooped section extending over the edge of your board and resting on the balsa.

a carbon rod that's glued between the spars in one panel. It slides into an aluminum tube in the other panel.

Capstrips are then glued to the top of the ribs, which are flat (to accept the flat solar cells) rather than curved as in a normal wing. Part of the trailing edge where the solar cells overlap it must have a notch sanded in it to accept the cells. The top sheeting is then applied to

Right: the Power Switch 20, which comes with a BEC, fits snugly just behind the motor. A BEC motor control is a must because the fuselage is very small. Below: with all the gear in the fuselage, there's barely enough room for foam padding.



INSTALLING THE SOLAR CELLS

After framing up the bottom sheet, the spar, the ribs and the leading and trailing edges, it's time to install the wiring and prepare for the solar cells. The wiring must be cut to length and inserted through holes in the ribs and top sheeting. A gold-pin connector is soldered onto each wire at the root end of the solar cells. The main wing joiner is the panel, and the sheeted wing is ready for the installation of the solar cells.

The cells have long, pre-tinned solder tabs on top and metal on the bottom. The tabs are soldered to the bottom of each adjacent cell, leaving about 1/32 to 1/16 inch between cells. This is done to prevent the tabs from touching the tops of the next cells and shorting.

(Continued on page 102)

FLIGHT PERFORMANCE

- **Launching and landing**
On the initial hand-launch, I almost crashed the Solar UHU. For its size, it's relatively heavy, and I thought it prudent to give it a fairly strong throw, but it pitched upward and was immediately on the verge of stalling. The stock Solar Speed 600 motor didn't have enough power to pull the model out of this condition, and I had to push the nose down with only about 7 feet of altitude to pick up speed. When the model started to fly forward with enough speed, it was only inches from the ground. It moved forward in a slow, shallow climb.

  The Solar Speed 600 motor has a low current draw to produce long run times, but it is somewhat lacking in power. It took 2 minutes or more to reach an altitude of about 400 to 450 feet. I told Hobby Lobby about this sluggish performance, and they sent me a replacement Speed 600 motor that gives acceptable climbs.

  The model's low dihedral angle, which exposes the solar cells to direct sunlight, makes it somewhat slow to respond to a turn-control input. It's wise to set up a long, straight-in approach that doesn't require any turns close to the ground. Once set up on final, the Solar UHU has a nice flat glide.

- **Slow-speed (thermal) performance**
The Solar UHU uses an airfoil that's apparently a compromise for mounting the solar cells. The drooped trailing edge is probably an attempt to offset any loss of lift that results from the flatness of the upper surface behind the spar. With its low dihedral angle, the flat-plate winglets help the model to turn and core in a thermal. Although the UHU is slow to start turning, once up on a wingtip, the winglets help hold the model in a very tight turning radius.

  Some finesse is required in thermalling the UHU to obtain long flights. The experienced pilot will, however, be able to achieve some long flights in moderately light lift. I found that the plane was easier to thermal than the standard UHU. On one flight, I was able to thermal for about 15 minutes between climb-outs, and I achieved a fourth climb. The in-flight charging appeared to make the difference (the last climb-out was slightly lower than the others). Total flight time?—about one hour.

  Even though the airfoil is fairly thin, the drooped trailing edge seemed to cause the model to fly at relatively low speeds. When the nose is held high (too much up-trim), the model is very difficult to turn. If the UHU is flown too slowly in a turn, it will tip-stall rather violently and make at least one full turn before recovering.

- **High-speed performance**
The Solar UHU is capable of flying at moderately high speeds, although it wasn't designed for this type of flying. As you'd expect, at higher speeds, it is easier to turn.

- **Aerobatics**
This model is meant for gliding, not aerobatics.

CHAMPIONS

(Continued from page 85)

four times U.S. national champion—among many other achievements. Naruke was Japanese national champion in '84, '88, '90 and '92, and he finished 5th in the '87 and '89 World Championships. Can one imagine a more competitive event?

Two names missing from the initial ranking were those of Wolfgang Matt of Liechtenstein and Hanno Prettner of Austria. Prettner won 1st place at an astounding eight previous TOCs, and Matt was a trophy winner in 10—including three 2nd places. Several at the competition understood that a major European pattern competition was being held on the same date and had regrettably prevented their attendance.

THE FINALS

Because of a freak, desert thunderstorm that generated gale winds, intermittent downpours, lightning and a couple of doses of hail, a third day of qualifying scheduled for Saturday was cancelled. After two days of competition, Somenzini had crept up to 2nd place and von Linsowe to 3rd; Stricker had fallen to 4th, and Ivan Kristensen had edged Cunningham out to take 5th place. These were the finalists who would start the competition with a blank slate on Sunday morning. Final rank would have nothing to do with specific scores compiled on previous days.

At the end of that memorable, last day of competition, Hyde had maintained his supremacy with a total score of 84,295.823, which earned him his second TOC 1st place. Stricker took 2nd with a score of 82,197.021. Somenzini achieved an impressive 3rd with 81,707.004 points. Von Linsowe took 4th with 80,718.157 points, and Kristensen 5th with 77,730.850.

In the freestyle competition, Hyde, with a score of 18,115, triumphed by a tiny margin over Somenzini, who accumulated 18,045. This event is judged according to "originality, versatility, harmony and rhythm, and execution," and the routines of the competitors were all quite different. Hyde continued to display virtuosic technical proficiency, and Somenzini his nearly legendary imaginative style.

In qualifying and finals freestyle competition, several competitors hung their planes by the prop, either in a stationary attitude or slowly rotating through torque rolls. Although this is just one of countless aerobatic maneuvers, it is, indeed, one of the most dramatic. At one point in his routine, Somenzini, flying with orange smoke, hung his plane by the prop, and through some sort of control-stick legerdemain, induced the plane to turn a slow-motion somersault and then regain its position, again hanging nearly motionless from the prop. He also achieved the slowest, flattest inverted spins this reporter has ever seen.

Von Linsowe surprised the spectators with a dramatic, smoke-belching, powered, freestyle routine (narrated by his brother John) that finished with a delicate, dead-stick aerobatic ballet from high altitude, topped off with a dramatic side-slip landing. He finished 3rd in freestyle, with 17,765 points.

A JOB WELL DONE

The TOC occupies a special place in U.S. aeromodeling. It promotes the sport of R/C aerobatic competition in a highly visible and dramatic manner. Bill Bennett, an R/C enthusiast and chairman of the board, Circus Circus Enterprises Inc., deserves special thanks for his past and continued sponsorship and support of the TOC. Others who also deserve thanks include Steve Rojecki (contest director), James "Doc" Edwards (chief judge), Maurice Franklin (announcer), Tom Tomlinson (marketing director for Circus Circus hotel and casino), the judges and many more too numerous to mention.

The TOC also is a notable event for hobby dealers. Horizon Hobby Distributors sponsored a trip to the TOC for its dealers and hosted two cocktail parties at which dealers and the Horizon staff exchanged ideas, and where new-product announcements were made.

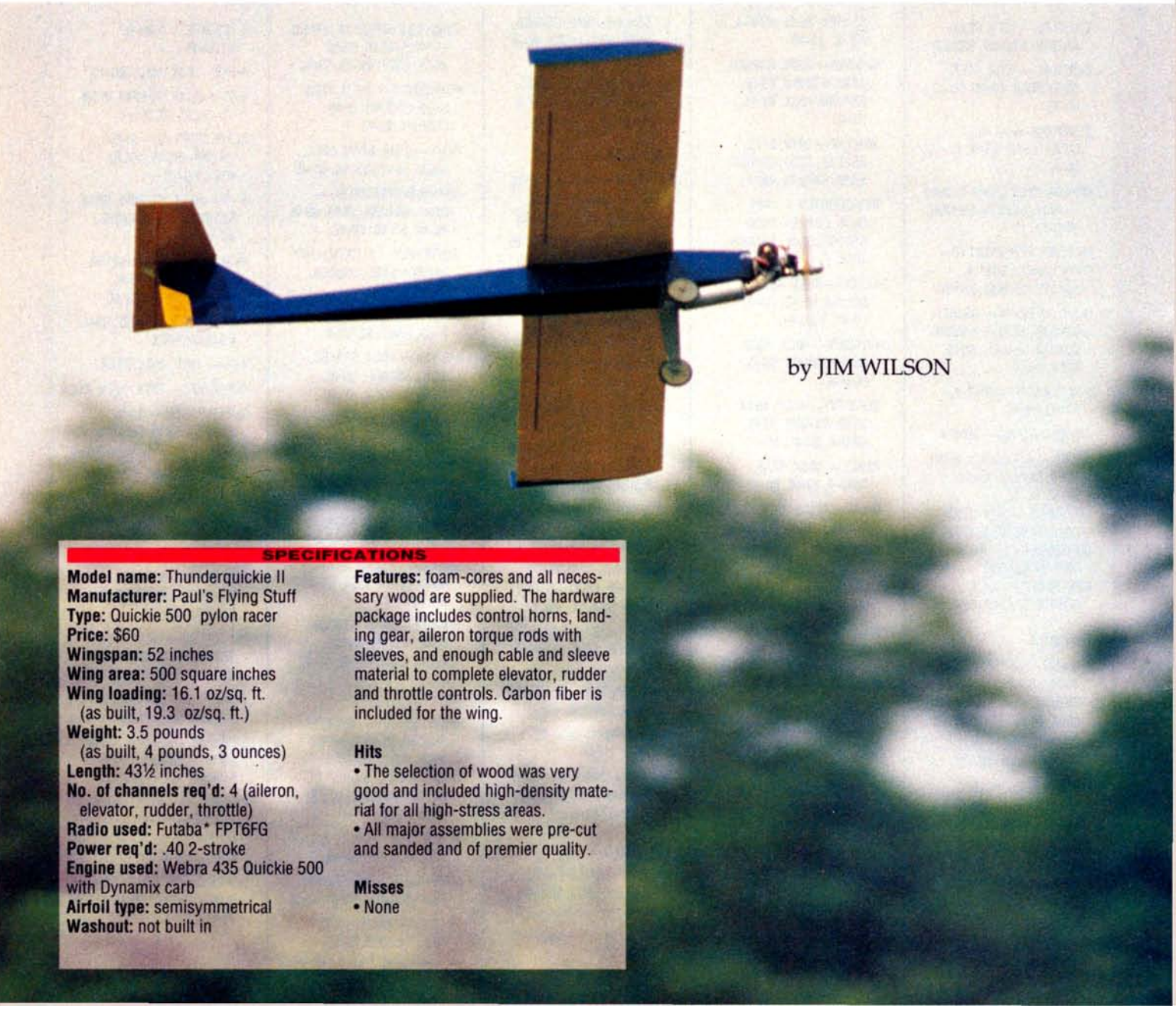
If you are a modeler and wish to attend, note that there is no charge other than the time and effort to get to the flying site. If you want a

(Continued on page 102)

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

A proven entry-level ship from Paul's Flying Stuff

Let's Race a THUNDER



by JIM WILSON

SPECIFICATIONS

Model name: Thunderquickie II
Manufacturer: Paul's Flying Stuff
Type: Quickie 500 pylon racer
Price: $60
Wingspan: 52 inches
Wing area: 500 square inches
Wing loading: 16.1 oz/sq. ft. (as built, 19.3 oz/sq. ft.)
Weight: 3.5 pounds (as built, 4 pounds, 3 ounces)
Length: 43½ inches
No. of channels req'd: 4 (aileron, elevator, rudder, throttle)
Radio used: Futaba* FPT6FG
Power req'd: .40 2-stroke
Engine used: Webra 435 Quickie 500 with Dynamix carb
Airfoil type: semisymmetrical
Washout: not built in

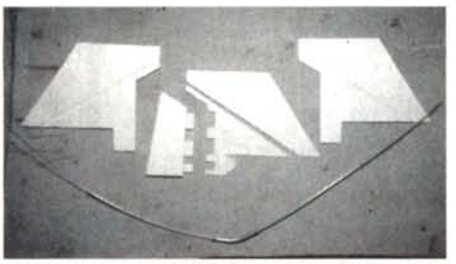
Features: foam-cores and all necessary wood are supplied. The hardware package includes control horns, landing gear, aileron torque rods with sleeves, and enough cable and sleeve material to complete elevator, rudder and throttle controls. Carbon fiber is included for the wing.

Hits
- The selection of wood was very good and included high-density material for all high-stress areas.
- All major assemblies were pre-cut and sanded and of premier quality.

Misses
- None

QUICKIE II

THE AMA Quickie 500 class racing was developed as an entry-level event to provide an inexpensive introduction to pylon racing. Because they use simple rules and stock, readily available powerplants, "Quickies" are not only racing planes, but also are excellent sport aircraft that are right at home in fun flys or Saturday-afternoon hot-dogging. Manufactured by Paul's Flying Stuff*, the Thunderquickie II is a competitive pylon-racing design that I have been racing for the last two years. If you want to get started in racing, it's a good entry-level choice. On the circuit, it has withstood the test of time.



Vertical fin and rudder are shown prior to lamination. The small piece of brass tube on the control-rod sleeve eliminates any slop in elevator travel. The sleeve is mounted flush with the bottom of the fin.

KIT CONTENTS

The selection of wood in the review kit was very good, with high-density material for all the high-stress areas. In addition to the strength of the high-density balsa, enough plywood was supplied to provide laminations for the vertical stabilizer and spline material for all edges of the tail surfaces. All major assemblies were pre-cut and sanded and of premier quality.

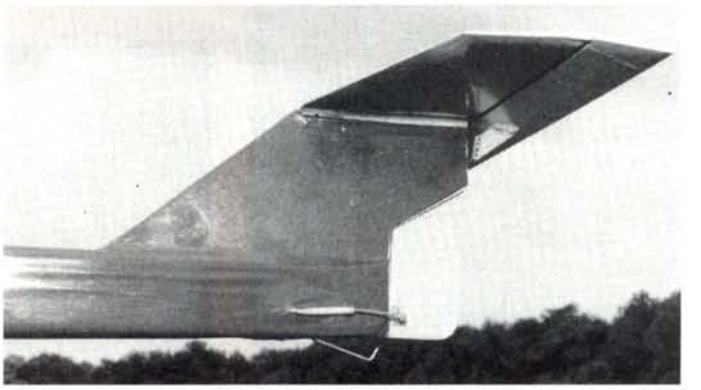
Although no fiberglass was provided for the wing center section and firewall reinforcement, a 48-inch length of carbon/fiber laminate was included for wing "spars." Be very careful when handling this material, as tiny carbon-fiber splinters—one of the not-so-nice aspects of high-tech materials—can sometimes be found on this or any similar material that incorporates carbon fiber. When you open your kit, carefully remove the carbon fiber from the parts bag and put it in a separate plastic bag until required for construction.

Kit contents: foam-cores, wood, carbon fiber and more.

The plans are two printed sheets of scaled general drawings. As all the major parts come pre-cut and sanded to exact size, full-size plans are not required. A 12-page printed set of excellent step-by-step instructions is provided. The instructions do not include photos, as none are required for the straightforward construction utilized.

The hardware package includes control horns, landing gear, aileron torque rods with sleeves, and enough cable and sleeve material to complete elevator, rudder and throttle controls. Before starting construction, it would not hurt to highlight in red the "Caution" contained on page two regarding working with carbon fiber. Better safe than sorry!

About the only things required to complete the Thunderquickie II are the adhesives, covering material, main wheels and axles, a few control end fittings, a bit of glass cloth, a cylindrical fuel tank with tubing, some coarse and fine sandpaper with



Small rudder provides ample authority. It's mainly used during takeoff and landing.

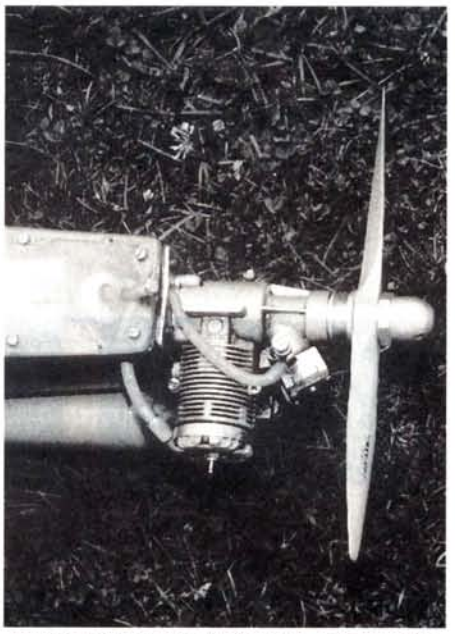
FLIGHT PERFORMANCE

- **Takeoff and landing**
With a power-to-weight ratio of 0.39hp per pound of aircraft weight, and the engine at full song prior to release by your caller, takeoffs are made with full up-elevator and are very close to being instantaneous. Landings, on the other hand, take some getting used to. All Quickies have a very good lift-to-drag ratio combined with low wing loading. Add to these features the desire to save a good balanced propeller, and the only feasible way to land is dead-stick. A typical landing requires the pilot to kill the engine, line up for a long, straight-in approach, and watch the plane whistle by and glide the full length of the field at 2 feet of altitude before you dump it in the weeds 10 feet beyond the outer boundary. Landings really get to be fun at the end of each heat when all four contenders seem to try to do this at the same time.

- **High-speed performance**
Speed with good handling characteristics is what the Thunderquickie II was designed for and what it does very well. The T-tail configuration works its magic in the "bank and yank" turns around the pylons by allowing a smooth transition from the full knife-edge high-G turns to straight, low-level dashes down the chutes. Really good competitive pilots are now turning heat times of 1 minute, 10 seconds, and below. A lap every 7 seconds really keeps pilots and callers spinning.

- **Low-speed performance**
Because of the basic requirement that a racing plane be stable at high speeds, all control throws are set for very small deflections. This does not lend itself to good control characteristics at very low speeds. If dual rates are not available or are not utilized, the Quickie, set up for racing, can be a handful at slow speed.

- **Aerobatics**
Although designed to go fast and turn left for racing, by reducing the speed and increasing the control throws, you can make the Thunderquickie into a great aerobatic flier. Low weight, good wing area and clean lines all add up to aerobatics, especially so in the vertical. A sharp pull to vertical with a bit of aileron puts you into a rolling climb that is out of sight in just seconds.



A Lexan window reveals the tank. Rules require that the tank be visible.

elbow grease and a few hours a night for one to two weeks.

SHEETING THE FOAM-CORE WINGS

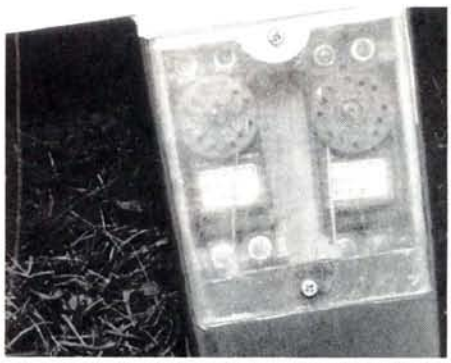
Although this kit is not classed as an ARF, it is pretty darn near it, because you can get into the air with minimum construction time. Let's build. Sheeting the foam-cores of any Quickie is an easy exercise. By the rules, the wings are of straight, constant-chord construction and are small enough to be easy to handle. If you follow the instructions carefully and take the time to prepare and sand each of the four wing skins prior to assembly, assembly will take only the skill of a good sandwich maker. Butter the core side of the skins with a thin layer of Hobby Poxy Two*. Make sure the carbon fiber is on the inside of the bottom skins. Be sure which is the left wing and which is the right wing, and do a good imitation of Dagwood Bumstead.

Top the wing sandwich off with all the heavy books you have in the house. After a full 24 hours curing time, even Dagwood couldn't eat this sandwich, and you'll have a set of very straight, solid, strong wings. Add leading and trailing edges, join the wings with Hobby Poxy Four using the lower cradle, but don't add dihedral! Trust Paul on this one. Finish the wing as instructed; the total time invested will be about four hours (plus curing time). For a reference on sheeting and glassing foam-core wings, see Frank Tiano's articles in December 1990 and January 1991 *Model Airplane News*. *[Editor's note: also see Jef Raskin's article in this issue on sheeting wings using double-sided adhesive tape.]*

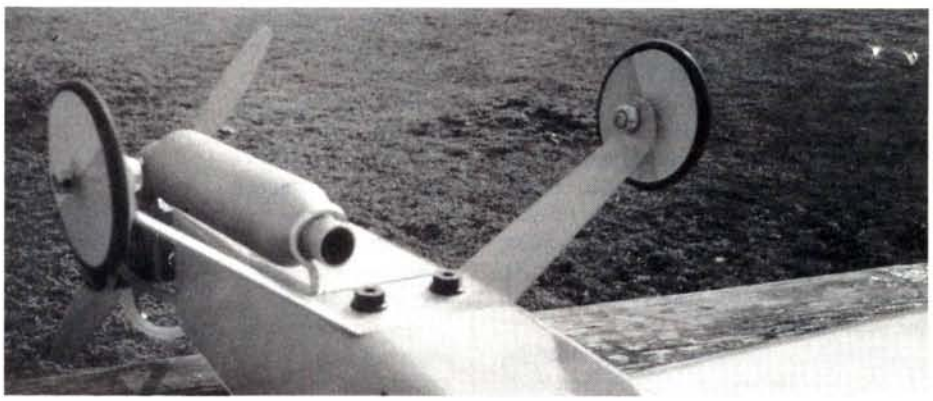
FUSELAGE

The fuselage is just a reinforced box, but take the time and care to build it straight. The parts in the kit that I received did not have the saw cuts mentioned in the instructions for marking the center lines, but they did have faint pencil lines. I did take the liberty of laminating 1/16-inch plywood doublers to the inside of the nose section for reinforcement—this, out of respect for the engine I intended to install. The time it takes to build the fuselage is about four hours.

Build the vertical fin and rudder accord-



Author also installed a Lexan window above the elevator and rudder servos.



Landing gear and muffler installation.

WEBRA 435 QUICKIE 500 PYLON

The Webra 435 Quickie 500 is shown with a Dynamix carburetor.

The Webra 435 Quickie 500 .40 engine, distributed by Horizon Hobby Distributors*, is a powerhouse designed and constructed specifically for AMA Quickie 500 rules. The engine comes equipped with a Dynamix (slide valve) front-mounted carburetor and a side-mounted muffler with a pressure tap. (My carb had a low-speed adjustment, but the Dynamix carb now shipped with the engine does not.) The piston/cylinder combination is of ABC construction. The machine work and fits of this engine are precise and tight..

Webra lists a 1-kilowatt power output from this .40-size engine. That equates to about 3.38hp per cubic inch. It was not too long ago that 1hp per cubic inch was a very respected output for the best of the WW II fighter-aircraft reciprocating engines; 1.35hp from 19 ounces of engine (with muffler weight) is pretty nifty engineering and construction.

I mated the Webra engine to a Thunderquickie II airframe and campaigned it here in the Northeast at over a dozen local races in the last two seasons. This has proved to be a continuing educational experience. Racing has consistently been a great, heartbeat-raising, adrenaline-pumping, physical rush.

On the educational side, it took a little time for me to get accustomed to the ins and outs of the Dynamix carburetor. Primarily, the Dynamix requires lots of pressure, so the pressure tap was relocated to the muffler flange, and an ⅛-inch Du-Bro* fuel fitting was modified and substituted for the original small tap. This helped to reduce, but did not fully eliminate, a tendency to go lean.

The addition of a check valve in the pressure line and an equa-flow system in the tank, whereby the pressure line goes to an ⅛-inch brass tube soldered to the fuel pick-up clunk, also helped. The final, and perhaps the most significant, improvement came when Horizon sent me an aluminum restrictor to install in the exhaust outlet (now a stock item with the 435 engine). The restrictor reduced the exhaust diameter from 9/16 inch to 7/16 inch. Now we have all the pressure the Dynamix needs.

Work with the Webra/Thunderquickie II combination paid off. By the end of the racing season, heat times had become consistent. We started finishing some heats on the same laps as the winners and even picked up a trophy in the novice class at two races. We are looking forward to the '93 season and a lot more racing.

Keep the plane light, the wings strong, the props blanced, and, above all, enjoy "going fast and turning left."

ing to Paul's instructions. Again, take your time, and laminate using Hobby Poxy Two and lots of weight on a flat, strong surface. Time spent on the vertical stab is about one hour. While waiting for the adhesive to dry, fabricate the next element, or sand the last one completed.

The stabilizer is the last and simplest to build by following the instructions. The installation of the stabilizer/elevator to the vertical fin is one of the key steps in building the Thunderquickie II. Time and effort taken here to get a solid, square joint is time well spent. Take extra care to ensure that the wing-to-stabilizer alignment is zero-zero, i.e., zero incidence on both.

Radio/servo installation is straightforward, but tight. Using standard servos for elevator and aileron and miniatures for the throttle and rudder helps save space and weight. Set all throws as per the instructions. Quickie 500 rules require that the fuel tank be visible. I installed a Lexan window over the fuel tank and also over the servos.

Use your favorite film to complete the aircraft with a good, highly visible color scheme. Problems with visual orientation are not desirable during races.

FLYING

First flights should be made at low to medium throttle settings with control throws as described in the instruction sheets. As confidence and speed increase, throws will decrease.

As the final line in the instructions says, "Good luck, and good racing."

**Here are the addresses of the companies mentioned in this article:*

***Paul's Flying Stuff**, P.O. Box 121, 1281 Rincon Rd., Escondido, CA 92025; (619) 743-5458.*

***Hobby Poxy Products**, Div. of Pettit Paint Co. Inc., 36 Pine St., Rockaway, NJ 07866.*

***Horizon Hobby Distributors**, 4105 Fieldstone Rd., Champaign, IL 61821.*

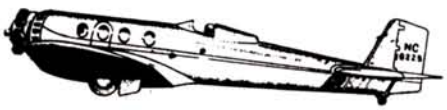
***Du-Bro Products**, 480 Bonner Rd., Wauconda, IL 60084.*

***Futaba Corp. of America**, 4 Studebaker, Irvine, CA 92718.*

CHAMPIONS

(Continued from page 94)

closer view of the principles behind the TOC and a feeling for the fellowship and camaraderie of the aerobatic competitors, a dinner banquet held on the eve of the finals at the Excalibur Casino is a must. Tickets are available throughout the event at the concession stands at the flying field. The TOC is a showcase of the finest aerobatic model aircraft and the best pilots in the world. If you can make the next one in '94, don't miss it.



UHU

(Continued from page 92)

When the 10 cells have been joined, they are taped together on the bottom; this helps to keep the solder-tab connections intact when the cells are moved. The cells are then laid over the prepared surface of the wing and positioned to allow the connecting wires to run along each end.

When the airplane has been covered, the solar cells are placed on the wing, and the connecting wires are soldered to the tabs. The cells are then secured to the wing with clear tape. Take great care with final positioning, because you probably won't be able to remove the tape to reposition the panels without damaging some of the cells. As a matter of fact, I managed to crack one cell during assembly, and I cracked a second one when trying to remove the first damaged one.

When soldering the cells together, special care should be taken to keep the solder joints as smooth as possible. When I taped the cells to the wing panel, a cell cracked because it had a very small lump of solder on its bottom. I took the panel out into the sun, measured the voltage and was relieved to see that I was still getting more than 10 volts. I covered the crack with clear tape.

The two, large, curved winglets are glued to triangle-stock tips that have been glued to the wing, and the entire wing is finish-sanded.

(Continued on page 112)

UHU

(Continued from page 102)

FINISHING

After sanding them, I covered the wings with white Oracover*. I epoxied the vertical and horizontal stabs to the fuselage and mounted the control surfaces with the supplied Graupner hinge tape. I painted the canopy with Coverite's* Black Baron black spray paint and applied the supplied graphics.

RADIO AND FLIGHT-SYSTEM INSTALLATION

The fuselage is very small—not much bigger than that of a hand-launched R/C glider. This requires the use of small radio equipment and a BEC-equipped motor control. I use a Cirrus* 5 PCM with two CS-133 microservos and the Graupner* Power Switch 20 with BEC. The two servos are mounted at the rear of the wing opening.

The receiver is positioned on the plywood tray forward of the servos and under the wing-mounting web. Connectors that supply the battery with charge current must be soldered to the positive and negative leads of the battery pack. These leads are joined to connectors in the wing leading edge. The flight battery is then slid through the canopy opening and into place on the canted plywood tray that allows it to be slid back under the servo/receiver tray.

CONCLUSION

The Graupner Solar UHU is an interesting change of pace. It isn't a model for average fliers as it takes finesse (experience) to master long thermal flights. Because the solar cells are fragile, the model should be landed with care. If you're looking for something out of the ordinary that employs advanced technology, the

(Continued on page 116)

video views

by JEF RASKIN

AEROBATICS: FLYING THE MANEUVERS

***Subject**: Full-scale aerobatics*
***Source**: Experimental Aircraft Association, P.O. Box 3065, Oshkosh, WI 54903-3065.*
***Summary**: Useful flying techniques, great shots of interesting aerobatic planes.*
***List price**: $29.95*
***Length**: 45 minutes*

"Aerobatics is the most exciting thing you can do with an airplane."
—Clint McHenry, world champion aerobatic pilot

In flying R/C airplanes, one of our objectives is to model the flight of their full-size brethren. Furthermore, most modelers love airplanes, which is why we go to air shows and aircraft museums. This gives us two reasons to watch this tape: one, to learn about flying aerobatics, and two, just to watch lots of great flying and interesting aircraft! The maneuvers on the tape are flown by some of this country's best aerobatic pilots: Charlie Hillard, Patty Wagstaff, Bob Herendeen, Leo Loudenslager, Tom Poberenzy and Clint McHenry.

Each maneuver is presented in no fewer than five ways: Aresti diagram, animation, view of the pilot, view from a wingtip, view from outside. Often we get an interior picture of the controls being manipulated. Because of this approach, "Aerobatics," on top of all its other attributes, is a good introduction to Aresti notation. The rules for flying a high-scoring maneuver are the same for model and full-scale competition, and the tricks shown for flying the full-size Pitts, Extra, or Sukoi apply to our models as well. To mention one, the section on how to stop a spin exactly on heading was especially helpful to me.

All in all, a fine, professional production, which I highly recommend.

MODEL ENGINES, VOLUME 1

***Subject**: The care and feeding of internal-combustion model airplane engines and more.*
***Source**: Hobby Supply South, 5060 Glade Rd., Acworth, GA 30101, (404) 974-0843.*
***Summary**: Thorough, accurate and valuable.*
***List price**: $24.95*
***Length**: 82 minutes*

I don't want to sound too enthusiastic about this tape, lest you think I am being paid off by the producers, but it's good stuff. If you want to know about model airplane powerplants, especially 2-stroke internal-combustion engines—which is what most of us fly—this is a great source. No heavy music; just lots of specific, detailed, accurate information presented clearly and with excellent animated diagrams and straightforward captions. A lot of love, care and effort went into this video, and it shows. Newcomers to engines will learn how to use and not abuse them, and even someone who first ran one decades ago (like your reviewer) found plenty of new information and useful reminders. The tape at every stage doesn't just tell you what to do, it makes sure you understand *why* you should do it and *how* it all works. The people who put this tape together not only know their stuff, but they also know how to teach it.

The tape covers selecting the right noise maker for your plane, mounting techniques, operating the engine, adjusting the carburetor, maintaining the engine for long life and proper operation, selecting props and fueling. The presenters—Denny Atkins and Ray Abadie—generally emphasize how to achieve safety, ease of starting, long life and performance. An eye-opening (or should it be ear-opening?) section on noise, done with professional expertise, was especially informative. If you are an engine buff, you will enjoy just seeing the wide range of engines they brought together for this tape, from tiny .010s to monsters that look as if they could tow a pair of water

(Continued on page 116)

Engine Reference Card

The tape comes with a plasticized engine-reference card that crams a lot of helpful information onto its 8½x3½-inch confines. The card includes a prop-selection chart for 2-stroke engines and crankshaft-thread sizes for everything from a Cox .010 to a Super Tigre 4500. If that's not enough, there's a spark-plug selection chart, displacement formulas in cubic inches and cubic centimeters and how to convert from one to the other, and the "80-percent" rule that is explained in detail on the tape (prop your engine to produce 80 percent of its rated rpm when it's standing still on the ground). And that's just the front of the card.

The back has an engine troubleshooting guide and—once that has helped you get the engine going—another section tells you how to adjust all the mysterious little screws on the carburetor. And there's a tap drill chart. Three guesses as to whether this card will go right into my flight box!

UHU

(Continued from page 112)

Solar UHU may be just the ticket. It's sure to open eyes at the flying field.

**Here are the addresses of the companies mentioned in this article:*
***Hobby Lobby Intl.,** 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444.*
***Oracover;** distributed by Hobby Lobby.*
***Coverite,** 420 Babylon Rd., Horsham, PA 19044.*
***Cirrus;** distributed by Hobby Shack/Global Hobby, 18480 Bandilier Cir., Fountain Valley, CA 92728.*
***Graupner;** distributed by Hobby Lobby..* ■

VIDEO VIEWS

(Continued from page 114)

skiers. Even rubber motors, CO_2s, jets and electrics are mentioned.

While eye and finger safety are repeatedly mentioned, the presenters are not shown wearing ear protection while bench-testing engines, something this reviewer believes is a must. The dangers of loud sounds are presented, but specific methods of avoiding hearing loss are not discussed. The only other problems with the tape are a few small editing slips and a place where the engine noise briefly drowns out the narration. These problems are very minor.

This is a thorough job, a prime paradigm of powerful pedagogy and a credit to the people who put it together. ■

TOMCAT

(Continued from page 56)

didn't re-glue, and I kept the accelerator at least 1 foot away from the glue bottles. (My pet peeve is having to stop construction to re-open glue nozzles, which seems to happen less often with Hot Stuff.)

In conclusion, I recommend the Great Planes F-14 if you're looking for jet-like speed from a "conventional" tractor airplane.

**Here are the addresses of the companies mentioned in this article:*
***Great Planes Model Mfg. Co.,** P.O. Box 788, Urbana, IL 61801.*
***Williams Bros.,** 181 Pawnee St., San Marcos, CA 92069.*
***MonoKote;** distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
***Robart Mfg.,** P.O. Box 1247, St. Charles, IL 60174.*
***Satellite City,** P.O. Box 836, Simi, CA 93062.*
***O.S.;** distributed by Great Planes Model Distributors.*
***Kraft Midwest Inc.,** 115 East Main, Northville, MI 48167* ■

PROGRAMMING

(Continued from page 82)

setting up a program for a plane or heli that's optimized for flight at your home field, but some of the contests that you attend are at high altitudes. You would set up the "alternate" program with a different set of control throws and mixes, e.g., a pattern ship would require more elevator-flap coupling and different travel throws to deal with the thin air; a helicopter would require a completely different set of pitch and throttle curves for hover, forward flight and aerobatics to perform as it does in the thicker air of your home field.

• **Trim Memory.** This function is hardly new, but the way Airtronics activates it is unique. After you have selected "Trim Memory," the first item is the "ALL" trim

(Continued on page 131)

CLUB OF THE MONTH

CHANNEL ISLAND CONDORS
136 Via Rosal, Camarillo, CA 93012

The Channel Island Condors' December newsletter contains information on an impressive list of R/C activities. One article describes and graphs the relationship of the pointer's position and temperature of a Top Flite MonoKote heat-sealing tool. A report on a Junior/Senior fun fly notes the successful use of "arrester" cables (we're curious to learn more) and includes a full-page photo of the contestants. Ray Hunt, the "Condor of the Month," is shown on the cover with his Super Tigre, 90-powered, Top Flite F-4U Corsair. Also mentioned are the various ducted fans and other R/C planes that the club displayed at the Point Mugu air show.

Minutes from a recent club meeting reveal the variety of club activities: John Strobel showed members a sample of Tuff Lite—a light, new building material. Bruce Mowry took in a set of floats for his ⅓-scale Piper Cub. (They took him about 200 hours to complete.) Evan Doughty showed off his "beasts"—modified and scratch-built "vertical climbing monsters" (a 1.08 in a .60-size plane?). Guest speakers Dan and Brook Gray, who pilot full-scale planes, showed a video and, as a raffle prize, they offered a ride in their full-scale Pitts S2A biplane.

We hope you enjoy your two free subscriptions. ■

HOBBY SHOP DIRECTORY

Retailers: Make your business grow with new traffic! Now you can advertise your hobby shop in the ***Model Airplane News*** **Hobby Shop Directory**. The listing will be published monthly and will be listed according to city and state. You have 3 to 4 lines, approximately 20 words, in which to deliver your sales message, plus space for your store's name, address and telephone number.

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- **$97 for six months**
- **$48.50 for three months**

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Hobby Shop Directory,
251 Danbury Rd., Wilton, CT 06897.
For more information, call toll- free
(800) 243-6685 and ask for Arlene Melko

CLASSIFIEDS

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R/C WORLD—ORLANDO, FL, CONDO RENTAL—2 bedroom, furnished. Available weekly or monthly. Low rates, 100 acre flying field with enclosed hangar. Swimming pool, tennis courts on site. Minutes from Disney World and Epcot Center. For information, call Micki at (800) 330-7243 or (407) 260-1252; fax (407) 331-3867; or write to: Page One Management Realty Inc., P.O. Box 4732, Winter Park, FL 32793-4732.

OLD-TIMERS, take a ride back in time to airplane modeling roots with this vintage book—*Gas Models.* A true collector's book from the early editors of *Model Airplane News*, it contains the best of modeling from the '30s and '40s, including great technical information and classic construction articles from the Golden Age period. $7.95, add $3 S&H for first item; $1.50 for each additional item. *Foreign:* (including Canada and Mexico)—*airmail*, add $7.50 for first item, $4.00 for each additional item. Payment must be in U.S. funds drawn on a U.S. bank, or by international money order. (Connecticut residents add 6% tax; Canadian residents add 7% tax.) Air Age Mail-Order Service, 251 Danbury Rd., Wilton, CT 06897.

CARBON FIBER—100 ft. 12k tow . . . $9.95 plus $2.00 S&H, to Discount Composites, P.O. Box 13, Bountiful, UT 84011-0013. [3/93]

VACUUM FORMING—Now in its third printing, the most comprehensive book on vacuum forming ever published for the hobbyist. 128 pages of hands-on information show how easy it really is to make your own plastic parts. Includes exclusive information on an easy-to-build 2-stage vacuum system for truly professional results. It's easy! Try It! $9.95 + $1.05 postage. Vacuum Form, 272B Morganhill Dr., Lake Orion, MI 48360; (800) 737-3000. $1 surcharge for Visa/MC. [3/93]

WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [5/93]

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/93]

WANTED: Old, unbuilt, plastic model kits. Planes, military, figures, cars, promo. Aircraft or missile desk models. Send list, price. Models, Box 863, Wyandotte, MI 48192. [9/93]

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE: 100 pages—timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid, U.S.; $20 foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [8/93]

MAGAZINE BACK ISSUES—Flying Aces, MAN, Air Trails, 1930s and '40s. FM, RCM and more. Send SASE for list to: Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [8/93]

SCALE MODEL RESEARCH: Aircraft documentation. World's largest. Over 3,300 different Foto-Paaks and 20,000+ drawings. Catalogue—$4. 2334 Ticonderoga Way, Costa Mesa, CA 92626. [6/93]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [10/93]

P/C—THE EASY WAY to simulate metal panels; $1 gets information and sample. Clarke Smiley, 23 Riverbend Rd., Newmarket, NH 03857. [6/93]

WANTED: model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649. [6/93]

HELICOPTER SCHOOL- 5 days of hands-on instruction with X-Cell helicopters and Futaba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 225 satisfied students and 7,500 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for *free* information and class schedule *now!* R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call 1-800-452-1677, outside USA (904)-6984275 or fax (904) 698-4724. [3/93]

FLY REAL PLANES! For information on obtaining your pilot's license, send $7 to H. Enterprises, Dept-MAN, P.O. Box 598, Antioch, TN 37011-0598. [3/93]

WANTED: Built or partially built Ercoupes, Mooney M-10 Cadets, or Cessna 150, 152, 172, 182. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [10/93]

WANTED: Original kit form, circa 1968-1970, "Schoolmaster" by Top Flight. Barbara Blythe, 484-B Washington St., Suite 341, Monterey, CA 93940; (408) 372-7586. [6/93]

WANTED: Original kit form, circa 1960-1963, Eindecker model, free flight or R/C. Barbara Blythe, 484-B Washington St., Suite 341, Monterey, CA 93940; (408) 372-7586. [6/93]

BATTERY-BACKUP SYSTEM: Build your own. Simple, inexpensive, reliable. Plans—$1 and SASE. D. McIntire, 1027-3 Chestnut, Wainwright, AK 99703. [2/93]

WANTED: model rocket catalogues, magazines, certain rocket kits and engines (1958 to 1975) from Estes, Centuri, Model Missiles, Vashon, Coaster. Art Nestor, 230 Arthur St., Zelienople, PA 16063. [6/93]

THREE THOUSAND-plus old-time plans, rubber gliders, three-views, CL, R/C, boats. Largest illustrated catalogue available—$4. Refundable. Allen Hunt, P.O. Box 726 C, Dunbar, WV 25064-0726. [5/93]

CAD-DESIGNED, Space Shuttle mailbox prints—$14.86; ceramic jumbo-jet birdhouse—$24.95. Hangar 18 Reproductions (Dept. ma), P.O. Box 153, Chelsea, OK 74016. [8/93]

HELICOPTERS. New, used, buy, sell, trade, build, repair, parts and teach. Best prices around! Hobbies Unlimited (817) 295-5003; Burleson, TX. [4/93]

DISPOSAL—Over 50-year aviation collection: slides, photos, negatives, three-views, documentation material. No list; sent wants and SASE to Dustin Carter Aviation Collection, P.O. Box 2114, Valley Center, CA 92082; (619) 742-1783. [4/93]

PLANS ENLARGED—Scanning/plotting services; CAD/printer plotter software. Free information. Concept, P.O. 669E, Poway, CA 92074-0669; (619) 486-2464. [3/93]

FROSTING ON THE CAKE! The best "stick-on" graphics anywhere! Spice up your next ho-hum covering job with these eye-catchers! Free catalogue. Silicon Valley R/C Technologies: (800) 822-1500. [6/93]

NONE BETTER in the universe! The best VHS flight-instruction tapes available anywhere! Silicon Valley R/C Technologies: (800) 822-1500. [6/93]

FOR SALE—Airline models 1:6000-scale mounted inside reflective display case. Send $1 for brochure to Aviation Images, 3864 Schiff Dr., Las Vegas, NV 89103. [3/93]

WANTED—1936 or older, *Model Airplane News, Air Trails, Popular Aviation, G-8 Battle Aces, Flying Wings, Flying Aces,* and other aviation, model, or pulp magazines. Must be in good to excellent condition. John Laughlin, 5227 Marigny St., New Orleans, LA 70122; (504) 288-6279. [3/93]

UNBUILT PLASTIC MODEL KITS—1/72 and 1/4 scale from 1950 to present. For list, write Box 151, Carbon, Alberta, Canada. T0M 0L0. [5/93]

YOUR PAINT IN SPRAY CANS. We custom-package your paint in 12-ounce spray cans—lacquer or enamel. Any quantity, $4 per can. Metro Authentic Finishes: (800) 878-3378. [3/93]

ARF KITS—Ryan-style design; 52" and 72" wingspan. For information, write to Design Consultants, P.O. Box 2189, Culver City, CA 90231. [7/93]

PROGRAMMING

(Continued from page 116)

function. Pressing the "YES/INC+" key causes the transmitter to memorize the distance from neutral of the trims. Next, turn off the radio and physically re-center the trims that you wish to affect. When you turn the radio back on, it's re-trimmed.

ALMOST PERFECT...A FEW CRITICISMS

• **Glider.** Why is there no C-MIX (compensation mix) in the glider mode? It should be available (as it is in the two other modes) for the ability to create your own mixes or to accommodate some of the wilder kits on the market, e.g., the Klingberg 100.

• **Aeroplane.** I would like to see a spoiler function in the aeroplane mode. Many of us have discovered the value of spoilers coupled to the throttle as a lift-destroying device. This function can also automatically

(Continued on page 136)

PRODUCT NEWS

U.S. AIRCORE
KnightHawk™

The KnightHawk is an all-weather, sport/utility, multi-mission (AWSUMM™) airplane that comes equipped with steerable nose- and tail wheels. You can build the KnightHawk for ailerons only and activate its fully functional flaps later. It can be fitted with Explorer™ Floats (they enable you to operate the KnightHawk from water, snow and wet grass), and it has highly visible markings on its wings, tail and fuselage. Specifications: wingspan—64 inches; length—43 inches; no. of channels req'd—4; engines—.40 to .50 ball bearing 2-stroke.

Price: $169.95

U.S. AirCore, 4576 Claire Chennault, Hangar #7, Dallas, TX 75248; (800) 336-0602.

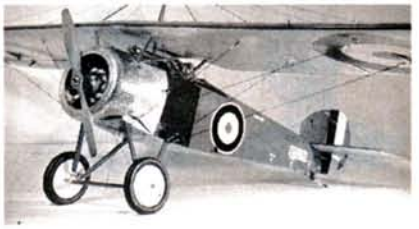
GUILLOW'S INC.
B-29 Superfortress

Guillow's newest addition to its Series-2000 scale models is the 1/32-scale B-29 Superfortress. It can be built as the Enola Gay (the bomber that dropped the first atomic bomb on Japan) or as a B-29 that served in the Korean War. This balsa model has a 53-inch wingspan and detailed, vacu-formed nacelles, nose canopy, gun turrets and observation domes. Also included are decals for both versions, silkspan covering material and plastic wheels.

Part no. 2005

Price: $52

Guillow's Inc., P.O. Box 229, Wakefield, MA 01880; (617) 245-5255.



AIRDROME
Sopwith Swallow Plans

Modified plans for this remarkably detailed 2-inch-scale, 60-inch-span 1918 Sopwith Swallow are now available for geared .40 Astro systems. Complete wings, formers and ribs are fully shown, and Airdrome gives many hints to help you build a light, strong, balsa structure. Intended to be a clean, electric alternative for dedicated scale gas modelers, the Sopwith Swallow can be built to any degree of detail—sport, fun, stand-off, or all the way to AMA precision scale.

Price: $35 (2 sheets); add $4 for rolled plans in tube.

Airdrome, Box 1425, FDR Station, New York, NY 10150; (212) 421-1440.

IKON N'WST
Monocoupe D-145

The new, 1/4-scale, 96-inch-span Monocoupe D-145 is a replica of Lindberg's special D-145. Most of the hardware you'll need for this easy-to-build model is included, as are the airfoil-shaped struts and the decals. The landing gear is made of strap aluminum; the cowl, pants and fairings are made of fiberglass, and all the parts are hand-cut. The takeoff and flight characteristics of this easy-to-handle plane are great. It weighs 15 pounds, has a cowl diameter of 9.75 inches and has a short nose and a long tail so it balances well with heavy radial engines

Price: $270 (plus $10 S&H)

Ikon N'Wst, P.O. Box 306, Post Falls, ID 83854; (800) 327-7198.

CARLSON ENGINE IMPORTS
MVVS 2.5 DF Diesel Engine

This front-intake, rear-exhaust engine has a double-ball-bearing-mounted crankshaft and Schnuerle-type transfer ports, and it starts easily and handles well. The full-function R/C throttle produces excellent response and smooth idle. The bore and stroke are 15 and 14mm, for a displacement of 2.47cc/.15 cid. This diesel is rated at .65hp at 24,000rpm and weighs 7.2 ounces. Suggested props are 7x4 to 9x5. An optional mini-pipe muffler is available.

Price: engine—$80; muffler—$20 (plus $3 S&H).

Carlson Engine Imports, 814 E. Marconi Ave., Phoenix, AZ 85022; (602) 863-1684.

MIDWEST
Cherokee .40

The Cherokee .40, which will be available in March, is truly versatile. It's a great second trainer and sport flier! If you're an accomplished flier, the Cherokee offers you great flight characteristics, and its semisymmetrical airfoil makes it capable of many aerobatic maneuvers. It's easy to build and takes very little time to assemble. The kit contains the best wood, precision-cut parts, a sturdy vacu-formed cowl and a clear canopy. Specifications: wingspan—61¼ inches; wing area—664 square inches; weight—5½ to 6½ pounds; no. of channels req'd—4; engine req'd—.40 to.46 2-stroke, .40 to.50 4-stroke.

Part no. 176

Midwest Products Co. Inc., 400 S. Indiana St., P.O. Box 564, Hobart, IN 46342; (219) 942-1134.

PRODUCT NEWS

JR
703 Ball Bearing Retract Servo

Less than 1 inch high, the 703 is the lowest-profile retract on the market. Its super-slim shape makes it the easiest retract to mount in wings or fuselages. The 703 is also the lightest low-profile retract available. Its meager weight of 1.16 ounces helps you compensate for the weight of the retracts themselves, and this makes your plane more responsive. An unbridled torque of 93.2 ounce/inches also makes the 703 the most powerful low-profile retract servo available. Dimensions—.88wx1.73lx93h; speed—1.36 seconds/160 degrees.

Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-0022.

GLENNIS AIRCRAFT
Pneumatic Brake

Glennis Aircraft now offers pneumatic brake systems for its line of scale wheels and tires. The simple, aluminum, three-part brake unit has a low-profile brake drum that will fit the narrowest of wheel rims. An adjustable restricter valve is included. The system includes a valve, a restricter, a T-fitting, an air line and brakes.

Price: $130

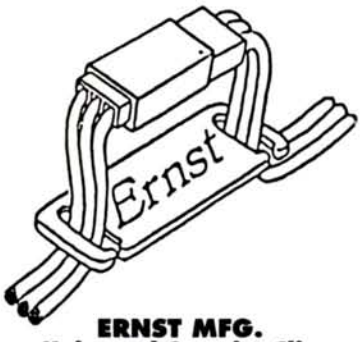
Glennis Aircraft, 5528 Arboga Rd., Linda, CA 95901; (916) 742-3957.

CROWN MODELS
Hawk MKV

This striking new prop jet is designed for pilots who want jet performance in a sport aircraft. The seamless, white-gelcoated, epoxy/glass fuselage has three NACA flush inlets to cool the completely enclosed engine system. It also has pre-installed main-wing hold-downs. Foam wings have been jig-cut for accuracy and sport a NACA drooped tip for excellent low-speed handling. All necessary hardware is included. Specifications: engine req'd—25-46; wing area—588 square inches; wingspan 48½ inches; length—40 inches; weight—4 to 6½ pounds.

Price: $149.95 (plus $5 S&H)

Crown Models, 316 Locust St., P.O. Box 707, Delavan, IL 61734; (800) 642-9574.



ERNST MFG.
Universal Security Clip

This is an updated version of the original Ernst security clip for the old-style Futaba plug. With so many radios available today, you need something that works with all popular radio types to provide the same safety feature. It's a simple flat plate with a slot in each end; simply plug either your aileron extension or your battery-to-harness connection together and then insert the wires into the slots. Pull the clip up against the plug.

Part no. 151

Price: $1.49/pair

Ernst Mfg. Inc., 37600 Ruben Ln., Ste. B, Sandy, OR 97055; (503) 668-5597.

WINDSOR PROPELLER CO.
Classic Series Propellers

These propellers for 1.6 to 2.4 engines are now available in the following sizes: 10x6, 20x8 and 20x10. The semi-scale look is perfect for Super Cubs and other WW II vintage aircraft, and modelers who fly off water will appreciate the superiority of glass-filled nylon props that resist water absorption and splitting.

Price: $14.95

Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742; (916) 631-8385.

BOB HOLMAN PLANS
Catalogues

The "Best-in-Scale Dream Book" lists the plans that Bob Holman has drawn. It also includes plans, kits and accessories from a variety of sources. "RC Model World Plans and Construction Guide" contains many good scale plans, e.g., the 80-inch-span Beechcraft Model 18 ($28.95) and the 92.5-inch-span Spirit of St. Louis ($27.50). The catalogue also contains many good scale glider plans. "VTH Plans Catalog" from Germany contains plans from Germany, the U.S., Britain and France. You'll find many different types of aircraft in this catalogue.

Prices: $4; $6; $6 (plus $2 S&H).

Bob Holman Plans, P.O. Box 741, San Bernardino, CA 92402; (909) 885-3959.

PROGRAMMING

(Continued from page 131)

retrim the elevator so that spoiler deployment doesn't change the aircraft's attitude on approach. This system makes accurate landings common.

CONCLUSION

This radio should be a hot seller for Airtronics. It's so easy to program that hobby dealers who are only slightly active in R/C themselves will be able to give convincing demonstrations of it in their stores. Airtronics now has the edge in "user friendly"!

**Here's the address of the company that's featured in this article:*
***Airtronics**, 11 Autry, Irvine, CA 92718.* ■

FLUTTER

(Continued from page 61)

higher modes are probably involved—usually the second or third harmonics—as shown in Figure 2. Adding additional inboard balances nearer to the site of peak vibratory movement is a closer approach to the ideal uniform distribution of balance weight and is sometimes the only way to manage such difficult cases. Use of one inboard balancer at about 40 percent of the panel length from the root, and one tip balancer, giving a total balance factor of about 80 percent, may be required to handle flutter involving both the fundamental as well as the second or third harmonics. An 80 percent balance factor means that 80 percent of the balance weight that would be required to give perfect static balance has been used.

In the concluding part of this article, I will discuss in detail the construction and installation of mass balancers, and other things that can be done to prevent flutter, or fix it. ■

AIRWAVES

(Continued from page 9)

balance the props? Doesn't the factory do that? If not, how do you balance a prop? How does one add weight to something that spins so fast? Won't the weight just fly off with all the centrifugal force? What does balancing accomplish, and what would happen if I didn't balance my props? Have you ever published an article on prop balancing?

Your magazine is a lot of help to new modelers like me.

CHRIS FILTZ
Schofield, WI

Chris, the Du-Bro and the Robart prop balancer are both of good quality, and they're basic workbench items for any serious modeler.

Everyone will agree that an important item to address when flying model airplanes is vibration. Most of it can be eliminated by balancing your propeller. Vibration can cause undue fatigue on your airframe, cracks in glue joints, radio problems and even—eventually—control-surface flutter. To balance a prop, you don't add weight to the light blade; rather, you remove material from the heavy one. Most props are pretty close to being balanced, but they all need to be fine-tuned. Remove material (a little at a time) from the rear of the heavier blade's tip with a 100-grit sanding block. You want a balanced prop that will not rotate on the balancer, no matter what the angle of the prop. GY

ADVERTISER INDEX